ACTA RADIOLOGICA
EDITA PER SOCIETATES RADIOLOGICAS DANIÆ, FENNIÆ, HELVETIÆ, HOLLANDIÆ, NORVEGIÆ ET SUECIÆ

VOL. XI FASC. 1 · 30 : IV 1930 · N:o 59

# THE RESULT OF THE COMBINED SURGICAL AND RADIOLOGICAL TREATMENT OF CANCER MAMMAE AT RADIUMHEMMET 1921—1923

by

*Nils Westermark*

## Introduction

The question of the value of the combined surgical and radiological treatment of cancer mammae has, since PERTHES first published his report concerning the bad results following post-operative radiation, been studied at many clinics (ANSCHÜTZ, BÉCLÈRE, BORAK, HOLFELDER, JÜNGLING, LARSÉN and LYSHOLM, LEHMAN, LEE, SGALITZER and others) with different results.

As the result of the post-operative radiation of cancer mammae at Radiumhemmet was favourable according to the report of LARSÉN and LYSHOLM this treatment has been carried out at Radiumhemmet. Since 1921 also a pre- as well as a post-operative radiation has been used in many cases. In inoperable cases the radiation has been combined since the same year with the extirpation of the tumour by means of electro-endothermy. For further experience of the value of the combined surgical and radiological treatment of cancer mammae I have carried out an investigation of the material treated at Radiumhemmet during 1921—1923. The computation includes all cases that applied for treatment at or were sent to Radiumhemmet for treatment during this period.

To get at least a 5-year basis for all cases for the investigation I have not included any case receiving treatment later than 1923. As the preoperative treatment and the endothermic method were commenced in 1921, I have not included cases prior to this year in order to obtain a comparison between the different therapeutic methods.

During the period 1921—1923 307 cases of cancer mammae were admitted to Radiumhemmet, of which some were primary cases, some cases

had recently been operated upon and some cases had signs of recurrences or metastases. Out of these 307 cases 52 have had no treatment at all as such was either contraindicated on account of bad condition or refused by the patient. Of the remaining 255 cases, 93 cases, of which 22 of primary cancer and 71 of recurrences or metastases after a previous operation, have had radiological treatment only. These cases are void of interest in this connection and will only be mentioned in passing. 162 cases have received combined surgical and radiological treatment. In 75 cases this combined treatment has been operation and a post-operative radiation, in 45 cases the operation has been combined with a preoperative as well as a post-operative radiation and in 42 cases the tumour has been extirpated by means of electroendothermy, this extirpation being combined with radiation.

253 cases of the 255 cases treated have been examined several times every year until death has occurred or in those cases who are still alive up to the end of 1928. Of the 2 cases not traced, both belonging to the post-operative group, one was still alive 5 years after the end of treatment. She was then free from recurrences and at that time emigrated to America. The other case one was able to follow for three years when she was still free from recurrences. I have been unable to trace her since and in the following statistics I have reckoned her as dead from cancer.

In order to obtain some idea of the value of the combined surgical and radiological treatment as applied to the cases of Radiumhemmet I have compared the results obtained at Radiumhemmet with those obtained in cases treated only by surgery in Sweden (DAHLGREN, NEANDER, BORELIUS, BRATTSTRÖM, NYSTRÖM).

The comparison between the results of the combined surgical and radiological treatment and those of the surgical treatment only has been judged from many different points of view. The estimation of the result of the treatment is based partly upon a 5-year freedom from symptoms, partly upon finding out the frequency of the recurrences arising during certain periods of time after the commencement of treatment. As the surgical method of treatment, as also radiotherapy, are to be considered local methods of treatment, a satisfactory and interesting estimate of the value of these methods is obtained by noting the frequency of the local recurrences. Valuable information as to the palliative effect of the treatment is obtained by trying to find out the duration of life after the first sign of disease as also after commencement of treatment. As the data submitted by the patient regarding the time of appearance of the first symptom are extremely uncertain and vague this estimation must be only approximate.

## The Cases under Investigation and their Nature

For estimating the final results in all the therapeutic groups the cases have been divided up in accordance with Steinthal's classification. To group I have been referred cases with a movable tumour without clinical signs of metastases, to group II those with a movable tumour and clinically demonstrable regional glandular metastases and to group III cases with a fixed tumour with or without any clinically demonstrable metastases, or tumours with clinically demonstrable distant metastases.

On the basis of the clinical histories submitted I have also tried to estimate the average duration of the disease from the first appearance of symptoms to the operation. Naturally this estimation must be exceedingly approximate, as the data submitted by the patient as to the first symptom are uncertain and vague.

In consideration of the relatively limited material in this investigation I have not deemed it justifiable to include in any of my computations any case with a longer history than 10 years.

In most of these cases the diagnosis of cancer has been made by histological examination. In some of the cases, however, no histological diagnosis has been made; in these cases, however, the case has been clinically diagnosed by an experienced and skilful surgeon wherefore there would seem to be no doubt as to the validity of the diagnosis.

As has already been stated in the introduction we have hitherto not as a rule treated operable cases by irradiation alone. During the 3-year period submitted to this re-investigation altogether 4 such cases have been treated radiologically, 2 of which belong to Steinthal's group I and 2 to Steinthal's group II. In addition 18 cases of completely inoperable tumours belonging to group III have been treated solely radiologically. In these cases the treatment has only been of palliative nature. Lastly 33 cases have not had any treatment at all as radiological treatment was found contraindicated because of a bad general condition or generalisation of the cancer.

During this 3-year period 85 cases of recurrence or of incompletely operated cases have been referred to Radiumhemmet. Out of these cases 71 received treatment while in 14 treatment was found to be contraindicated.

In 31 cases or 43.7 % there has only been a question of distant metastases; in 18 cases or 25.3 % there were on admission to Radiumhemmet only signs of local recurrences, in 22 cases or 31 % local recurrences as well as metastases.

During the period 1921—1923 altogether 80 cases of cancer mammae recently operated upon have been sent to Radiumhemmet for radio-

gical post-operative treatment. Out of these, however, five never had any radiological treatment, two on account of advanced age and three because they refused, for one reason or another, to submit to the treatment. Thus 75 cases remain who have been subjected to radiological treatment after the operation. These 75 cases have been sent from no less than 19 different hospitals or surgeons in Sweden. Several of these surgeons have not sent all their operated cases to us but only those considered prognostically unfavourable and in which they have suspected early recurrences. For a right estimation of the result it would be desirable to divide up the material into groups, one group for each individual surgeon; this is scarcely possible, however, on account of the relatively small number of cases, as several surgeons have only sent one or two.

If dividing up the post-operative cases according to Steinthal's table on the strength of the data received from respective hospitals it will be found that of the 75 cases 10 or 13.3 per cent. belong to group I, 55 or 73.4 per cent. to group II and 10 or 13.3 per cent. to group III. The average duration of the disease from the first symptom observed to the commencement of treatment is 15 months.

During the 3-year period subjected to this after-examination altogether 45 cases have received pre-operative treatment. Of these 35 cases have been operated upon by the same surgeon or his assistants. The remaining 10 have been operated upon in other places.

If these cases are divided up according to Steinthal's table on the strength of the clinical picture they offered at the beginning of the treatment, it will be found that 8 cases or 17.8 per cent. belong to group I, 31 or 68.9 per cent. to group II and lastly 6 or 13.3 per cent. to group III.

The duration of the disease from the first symptom observed to the commencement of treatment as judged by the data obtained has varied from no history to more than five years. The average duration for these pre-operative cases is 17 months.

The great majority of cases treated by electro-endothermy combined with radiological treatment is made up of inoperable cases or border-line cases previously refused radical operation by the surgeon. In only a small number of cases has there been a question of operability.

This group comprises altogether 42 cases, 2 or 4.8 per cent. belonging to Steinthal's group I, 14 or 33.3 per cent. to Steinthal's group II and 26 or 61.9 per cent. to group III. Several of the cases referred to group II are clinically and prognostically on the border-line to group III.

The duration of the disease from the first symptom to the commencement of treatment has in this group been on an average 24 months.

In table I the nature of the material has been classified in accordance with Steinthal's scheme for the post-, pre-operative and endothermic groups, whereby a basis for comparing the nature of the material in these groups has been obtained.

**Table I**

*The condition of the material before the treatment classified in accordance with Steinthal's scheme*

| | Op. and post-op. radiation | Pre-op. radiation | Electro-endothermy and radiation |
|---|---|---|---|
| Group I . . . . . | 13.3 % | 17.8 % | 4.8 % |
| Group II . . . . . | 73.4 % | 68.9 % | 33.3 % |
| Group III . . . . . | 13.3 % | 13.3 % | 61.9 % |

From this table it will be clear that the nature of the material for the post- and pre-operative groups is fairly uniform with slight displacement towards group I for the pre-operative cases. The cases in the endothermic group, on the other hand, prove considerably worse with a considerable excess of cases belonging to group III.

In table II I have compared the average duration of disease from the first symptom to the commencement of treatment, on the one hand in respect of the cases in NYSTRÖM's statistics and, on the other, the above mentioned three therapeutic groups.

**Table II**

*Average duration from first appearance of symptoms of cancer to treatment in all cases*

| Only operation (NYSTRÖM) | Op. and post-op. radiation | Pre-op. radiation | Electro-endothermy and radiation |
|---|---|---|---|
| 16 mths | 15 mths | 17 mths | 24 mths |

It will be found from this table that the duration is about the same for NYSTRÖM's cases as for the post- and pre-operative groups. The endothermic cases, on the other hand, show on an average a considerably longer interval, no less than 24 months, while NYSTRÖM's cases showed an average of 16 months. Judging from these figures it would seem as if the post- and pre-operative groups are of about the same stage as NYSTRÖM's cases while the endothermic group would seem to have an inferior clinical character.

## Methods of Treatment

### *1. Post-operative treatment*

The idea held as to the mode of action of radiotherapy in so-called post-operative or preventative treatment is often vague. With our present knowledge there can scarcely be a question of any preventative effect in the sense that tumours are prevented from arising through some influence on surrounding tissues. It would rather seem to be some direct or indirect action on cancerous cells possibly remaining after the operation which have not as yet become organised into macroscopically demonstrable recurrences. In that case we are dealing with a healing process, initiated by the treatment of early metastatic foci. It would seem to be borne out by a good many observations that a malignant formation in this stage of development, where a macroscopical tumour has as yet not become organised, reacts in a different way to the irradiation than in cases of fully developed metastases (FORSSELL).

The principles of the post-operative treatment as applied at Radiumhemmet are earlier described by LARSÉN and LYSHOLM and later by BERVEN. The technique is worked out on the basis of the experiences FORSSELL had gained when treating mammary cancer with manifest skin metastases and later on the experiences from earlier post-operative treatment where a favourable result was obtained.

On account of these experiences we give series of treatments, the first ones at intervals of two or three months, then at longer intervals according to the condition of the skin. In each series the operation field and the glandular regions are treated with repeated small doses.

During the whole treatment the patient is exceedingly carefully supervised and the local as well as the general reaction studied, the latter before all by repeated blood examinations. The reaction of the patient to the first applications determines the subsequent treatment.

The areas that should be irradiated in the first place are above all the operation field, and then, secondly, the regional glands, the axilla, supra- and infraclavicular fossae and the glandular region along the internal mammary artery. In irradiating the operation field the glandular area along the internal mammary artery is also included as also the infraclavicular fossa. In so doing the axillary region can also be got at from the front. To gain still further access to this region, the posterior axillary field is also irradiated from behind. Finally, radiations are also directed against the glandular region in the supraclavicular fossa.

As the area for the treatment of the operation field only includes the chest wall and it is desirable to avoid damage to underlying tissues,

lungs, heart and large vessels with their quantities of blood, we have not employed hard-filtered rays but considered it more expedient to use a filter of 4 mm. Al. By treating at a distance of 50 cm., a sufficiently even absorption is obtained by this filter within the layers, the possible seat of latent metastases, while the absorption in the deeper tissues are diminished by this latter technique. By using this distance one also obtains a homogeneous irradiation of the whole operation field, whereby only one therapeutic field is needed. In so doing a summation of effects is avoided by intercrossing in the deeper-lying tissues. On subsequent examinations we have nevertheless found a few secondary indurations in the lungs.

For the posterior axillary field and supraclavicular fossa where the glands are situated on a deeper plane we have used a filter of 0.5 mm. Cu + 1 mm. Al. In the treatment of this field we have been using a distance of 40 cm.

In brief, then, our therapeutic technique, yet adapted to each separate case, has been as follows:

Against a large area, corresponding to the operation field, limited above by the clavicle, below by a line approximately on level with the xiphoid process, medially by a line a few centimeters on the lateral aspect of the mid-line and laterally by the anterior axillary line, we give a series of 4—6 treatments, each of $^1/_4$—$^1/_6$ S. E. D., radiations being directed somewhat obliquely from within outwards. Filter 4 mm. and distance 50 cm.

Against a field corresponding to the posterior axillary region we give a series of 3—4 treatments, each of $^1/_3$—$^1/_4$ S. E. D. Filter 0.5 mm. Cu + 1 mm. Al. Distance 40 cm.

Lastly a similar series is given against the supraclavicular fossa.

In all, then, we give 10—14 treatments in the series, the first application being set in as soon as the operation-field has healed up, 2—4 weeks after the operation. After that we give an application every or every other day, all according to the reaction and general state of health of the patient. The applications are given against the different areas. The whole series of treatment takes 2—3 weeks.

The reaction after such a therapeutic series consists of a readily passing erythema; as a rule no brown pigmentation rer ins.

After 2 to 3 months another series is given, a similar technique being used, and this is repeated after another 3—4 months. In some cases a series of applications has been given again after six months. In all, then, 3—4 series are given in the course of 1 to $1^1/_2$ years. By this method we have never had any ill-effects from the treatment. The skin over the field of treatment shows no change but some dryness or a very slight brown pigmentation.

### 2. *Pre-operative treatment*

In the pre-operative treatment radiotherapy has for its purpose to act upon the tumorous tissue, its surroundings and possible metastases. In many cases it is also given with the view to establishing, by way of an absorption process, a diminution of the peritumoral infiltration and thereby facilitate the radical operation of the tumour. In addition, there is the aim of causing attenuation of the virulence of the tumour, thereby diminishing the danger of dissemination of the tumour through the surgical intervention. Lastly it would seem possible, according to some observations, that the healing process, initiated by irradiation of the tumour, may produce a certain resistance in the organism against latent metastases in an early state of development.

In planning the technique for the pre-operative treatment we have tried to find out the most suitable dose in order to obtain the best possible primary result. In elaborating our technique we have tried to use such fields and such direction of the rays as to cause the least possible damage to surrounding and underlying tissues and also to obtain as slight an effect as possible on the whole organism.

In this treatment we have used the so-called tangential method suggested by HOLFELDER and modified by FORSSELL. By this method absorption is avoided in the deeper tissues and the chest organs. The primary tumour in the breast is irradiated from two directions, from the medial and lateral aspects respectively, the rays being directed tangentially against the chest wall. Each of these fields is first exposed to a series of two treatments of $^1/_3$ S. E. D., 0.5 mm. Cu and 1 mm. Al. being used as filter. Distance 40 cm. After 1—2 weeks still another application of $^1/_3$ S. E. D. is given against each field with the same filter and at the same distance. The thoracic wall in the surrounding of the breast is well protected by lead so as to prevent the rays from passing into the thoracic cavity. The mamilla is also well protected by lead-rubber against damage.

In the case of glandular metastases having also been found on clinical examination, a series of treatments is also given for these. These applications have been given over two fields against the axilla, one from behind and one in front, with a filter of 0.5 mm. Cu and 1 mm. Al at a distance of 40 cm. Altogether about 1 S. E. D. has been given against each field. The dose is divided up into fourths or thirds of one S. E. D. We have latterly been using a filter of tin constructed by THORÆUS instead of copper.

The reaction after this therapeutic series shows itself in a slight redness of the skin. In the majority of cases the tumour has diminished considerably and in many cases it is impossible to palpate the tumour

3—4 weeks after the last treatment. In some cases this series has been repeated after 5—6 weeks. The subsequent operation should be carried out while the tumour is still under the influence of the radiological treatment. The most suitable time for the surgical intervention is 3—4 weeks after the last roentgen treatment. In the case of this time being surpassed, it is best to give a further series of treatment; the operation is then undertaken during the influence of this last series of applications.

The present technique is more intensive than the earlier one. Pre-operative treatment is now given in series as long as the tumour is diminishing or until it has disappeared. Three and sometimes more series are given with an interval of one to two months between the different series.

A microscopical examination of a cancer mammae treated in this manner shows widespread and degenerative changes in the tumour cells. Over large areas the cells nuclei are very poorly seen and present structure-less islands of chromatine. The protoplasm, too, shows signs of degenerative changes. The cell boundaries are blotted out over large areas. In several places giant cells can be seen, indicative of a reaction of absorption in surrounding tissues. In several cases these changes have been so prominent as to render it impossible to make a diagnosis of tumour.

After the operation a post-operative treatment is given. Yet regard must be taken to the doses used during the pre-operative treatment and the subsequent reaction. Many times it is impossible to treat the operation field because of atrophy of the skin.

### *3. Treatment by endothermy*

In the treatment of some kinds of malignant growths we have at Radiumhemmet since 1921 made use of high frequency currents, so-called electro-endothermy, combined with radiological treatment. By electro-endothermy the tumour has been removed altogether or been rendered necrotic, later to be shed off. In all cases this treatment has been combined with irradiation.

In the treatment of cancer mammae, too, this method has mainly been used in inoperable cases where the surgeon has refrained from radical operation. At the 3rd meeting of the Northern Society of Medical Radiology in Stockholm 1923 I described the technique elaborated for the treatment of cancer mammae by electro-endothermy as well as the preliminary results obtained by this treatment. In another paper I have related the development of the treatment of cancer mammae by these currents and their mode of action.

Whenever it has been possible to remove the tumour and metastases if present in the axilla by radical operation, the following radical method has been employed. By means of a knife-electrode producing a linear spark that readily severs the tissues, the whole breast with pectoralis major et minor are first cut out in one piece. By this operation we get a coagulated layer in the tissues a few mm. in thickness by which all blood- and lymph vessels become occluded. On coming across larger arteries one tries to get a more prolonged action of the high frequency current so as to cause coagulation of the blood in the vessels. In case, however, of complete coagulation not being obtained the bleeding is readily stopped by passing the current through an artery clamp applied on the vessel. In so doing, complete arrest of the bleeding is obtained. The resection of the breast with underlying muscles is followed by resection, also in one piece, of the glandular area of the axilla draining the breast. This resection is also carried out by the knife-electrode. In so doing, great care must be exercised so as not to injure the big vessels with consequent dangerous haemorrhage. By a suitable current and good command of the electro-endothermic technique this can be readily done. Nor have I in any of my cases seen any injury to these vessels. Experience of this method has also shown that the vascular walls resist, relatively well, the heat developed by these high frequency currents. This is probably owing to the blood-stream cooling the vascular wall, whereby this becomes less heated than other tissues. This cooling effect is probably greater in the arteries than in the veins on account of the more rapid current in the former. One should, therefore, be particularly careful in the neighbourhood of the axillary vein. This experience is supported by observations I have made in experimental investigations into the effect of high frequency currents on tissues, to be published later in another connection.

With the view of preventing thrombosis in the axillary vein the veins in the axilla are ligatured at their point of entrance into the vena axillaris. Bleeding from arteries, on the other hand, is dealt with in the same way as vessels in the chest wall and the breast.

After the breast with regional glands in the axilla have thus been extirpated in one piece by the knife-electrode the whole surface is treated by means of flat electrodes. This is to cause a more or less deep necrosis of the wound surface, all according to the depth of the cancer infiltration, the limit of this being passed. In the event of the cancer having infiltrated the musculature and the chest wall the coagulation is continued with through the entire chest wall. In 3 cases I have caused necrosis of the entire chest wall as also the immediate parts of the lung tissue. The chest wall and the lung tissue have subsequently separated off without the slightest complication arising. The healing in those cases has proceeded in a normal manner. This has probably been possible

because of the creation at the coagulation of a well marked ridge of reaction in the surrounding and necrotic tissues with the subsequent formation of thick granulation tissue that completely covers the whole wound surface. One of these cases is still alive after more than 5 years without any symptoms of cancer. Another lived for more than two years and then died of internal metastases. The third, finally, died within the course of six months of cancer.

With this treatment there arises a large wound defect that occupies half the chest wall from the mid-line to the posterior axillary fold.

In some cases without metastases or in which distant metastases are present, where one desires to remove the tumour as a palliative measure, as in cases of ulcerating or septic disintegrating tumours, I have not dealt with them quite so radically but only amputated the breast.

Because of a certain amount of risk of causing fire when using ether, we have in these operations been using chloroform anaesthesia.

Out of the 42 cases that during the period 1921—1923 were treated by electro-endothermy 2 died in post-operative complications, one in pneumonia and the other from thrombo-phlebitis. The operation mortality has therefore been 4.7 per cent.

The wound is left entirely open without any efforts to close or cover it. Immediately after the operation an ordinary dry dressing is put on and left on for 4—5 days. During this time only the outer part of the dressing is changed. The dressing should not be removed before that time as there is then some risk of tearing the necrotic tissues whereby haemorrhage may easily arise. During the fourth or fifth day it is generally easy to change the dressing without tearing the necrotic masses. Some bland ointment is preferably put on the fresh dressing e. g. boracic vaseline. The dressings are then changed daily.

During the stage of shedding, lasting 2—3 weeks, all according to the depth of the necrosis, one should not try to remove the necrotic masses with any kind of instrument because of the risk of haemorrhage. The necrotic tissues will be gradually shed spontaneously. In the presence of necrotic ribs, however, these should be removed in order to facilitate the healing. This, however, should not be done before the stage of granulation which appears after the stage of shedding. The stage of granulation lasts for 2—3 months in some cases, in those with extensive wound defects, however, somewhat longer. During this stage the surrounding uninjured skin is concentrically drawn in over the wound surface so as to rapidly diminish the defect. The remaining wound surface, no broader than 3—4 fingers, granulates rapidly and becomes covered with epithelium, a beautiful plastic cicatrix being left.

This endothermic treatment has in all cases been combined with ra-

diological treatment, the same principles and technique being adopted as in the pre-operative treatment.

One of the great advantages of endothermic treatment is the possibility of technically removing and completely extirpating a good many tumours technically inoperable by ordinary surgery.

The method, however, is also associated with great risks and drawbacks. The operation mortality is relatively great (4.7 % at Radiumhemmet). This high mortality may possibly to some extent be ascribed to the poor condition of some of the patients. Another risk is the possible occurrence of haemorrhage and thrombosis after the treatment. Among the cases of Radiumhemmet, however, we have had no cases of post-operative haemorrhage. Thrombosis, on the other hand, has occurred in one case, possibly due to the endothermic treatment. Another drawback is to be found in the slow and complicated healing of the operation defect after the endothermic treatment. This means a prolonged and time-consuming after-treatment for the patients who do not become fit for work so early as is the case after an ordinary radical operation.

### *4. Treatment radiologically only*

Some tumours have been treated locally, the same technique being employed as that used in the pre-operative treatment. The series have been repeated all according to the reaction and condition of the patients after the treatment. In a few cases, these tumours have, in addition, been treated by radium and then preferably at a distance. The patients have been given during a week or a fortnight 25—35 grm. el. hours at a distance of 5—10 cm., a filter of 3 mm. lead being used.

The glandular metastases have been treated in the same way as the regional glands in the pre-operative treatment. At present we treat by radium at distance with the technique above.

Because of the known relationship existing between the mammary gland and the ovarian- and thyroid secretions we have in some of the inoperable cases also been using sterilisation[1] treatment and thyroid medication. In the sterilisation treatment we have, as a rule, given altogether 1 S. E. D. over three different fields, two to the abdomen and one to the back, all directed against the ovaries. The treatment has been divided up into two to three applications against each field, each of $^1/_2$ to $^1/_3$ S. E. D. Filter 0.5 mm. Cu + 1 mm. Al at a distance of 30—40 cm. In the thyroid medication we have given thyroid tablets, 10 cgr., 1—2—3 times daily periodically during some months.

[1] Dr AHLBOM at Radiumhemmet will in the near future publish our experience about this treatment.

### *5. The radiological treatment of recurrences and metastases*

On account of the varying clinical pictures presented by cancer recurrences, from those of relatively local nature to a widespread generalization of the cancer the therapy adopted must also be individualised to suit the requirements of each separate case. It is of exceedingly great importance, therefore, first carefully to examine the patient and then adjust the treatment accordingly. It will not do to give a powerful treatment that would often have damaging influence on the general condition of the patient and the power of reaction. In cases of generalisation of the cancer where the general condition is bad, we consider radiological treatment contraindicated.

Local recurrences are, if possible, treated by radium, either by surface application or intubation or by radium treatment at a distance (in the event of more deeplying recurrences).

In surface applications the tumours are covered by radium containers in dental compound mass (BERVEN, EDLING). These containers are placed in this mass 2—3 mm. apart. The size of them has varied between 10 and 25 mm. The wall of the containers is made of gold and platinum with a filter equivalence of 1 mm. lead. Each tube contains 5—10 mgr. element. As a rule we use an extra lead filter of 1—2 mm., according to the depth of the infiltration. The treatment lasts for 20—40 hours. The reaction of the treatment shows itself in a shedding of the epithelium after 3 weeks. In intubation radium needles are used with a filter corresponding to about 1 mm. of lead, each containing 10 mgr. element. These are implanted in the tumour 1 cm. apart. Duration of treatment 3—4 hours.

In treatment at a distance, an aggregate dose of 8—12 and 25—35 gr. el. hours is given over several fields at a distance of 3 and 5 cm. respectively with an extra filter of 3 mm. of lead.

Some of the local recurrences have been treated by endothermy.

## The Result of the Treatment as Apparent from the 5-year Cure Rate

### *1. Post-operative treatment*

The ultimate result of the post-operative cases as apparent on re-examination 5—7 years after the operation and the commencement of the radiological treatment will be clear from table III. Table III shows the number of cases free from recurrence at the time of this after-examination, cases still alive but with signs of recurrences or metastases and those dead of cancer and intercurrent disease. It is also

possible to infer from the table the result after classification according to Steinthal's three groups as also the exact time of observation at the after-examination or death.

**Table III**

*Cases of cancer mammae treated by operation and post-operative radiation*

| Duration of life after commencement of treatment | Free from symptoms | | | | Still alive with symptoms of cancer | | | | Dead from cancer | | | | Dead from i. d. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | I | II | III | Total | I | II | III | Total | I | II | III | Total | I | II | III | Total | |
| < 1 year | | | | | | | | | | 9 | 3 | 12 | | 1 | | 1 | |
| 1—2 yrs | | | | | | | | | | 10 | 2 | 12 | | | | | |
| 2—3 yrs | | | | | | | | | 1 | 5 | 1 | 7 | | | | | |
| 3—4 yrs | | | | | | | | | 1 | 3 | 1 | 5 | | | | | |
| 4—5 yrs | | | | | | | | | 1 | 2 | 1 | 4 | | 3 | | 3 | |
| 5—6 yrs | 1 | 4 | | 5 | 1 | 1 | | 2 | | 1 | | 1 | | | | | |
| 6—7 yrs | 4 | 5 | | 9 | | | | | | 1 | 1 | 2 | | 1 | | 1 | |
| > 7 yrs | 1 | 7 | | 8 | | 2 | | 2 | | | 1 | 1 | | | | | |
| **Total** | **6** | **16** | | **22** | **1** | **3** | | **4** | **3** | **31** | **10** | **44** | | **5** | | **5** | **75** |
| | | | | 29.3 % | | | | 5.3 % | | | | 58.7 % | | | | 6.7 % | |

Out of 10 cases belonging to Steinthal's group I 6 are, on re-examination, found to be alive, free from recurrence. One is still alive with signs of cancer after having been under observation a little more than 5 years, 3 cases have died of cancer 2—5 years after commencement of treatment.

Out of 55 cases belonging to group II 16 are alive free from recurrences, 3 cases are still alive after 5—7 years with signs of cancer, 31 cases have died of cancer and 5 of intercurrent disease.

All the 10 cases belonging to group III have died of cancer. The aggregate result of the whole material then is as follows: 22 cases out of 75, or 29.5 %, are alive free from recurrences more than 5 years after commencement of treatment, 4 cases or 5.3 % are still alive on re-examination but with signs of cancer, and 44 cases or 58.7 % have died of cancer.

After an observation time of 3 years 45 % of the cases are alive free from recurrences while 44 % are dead; 11 % show signs of recurrences. After an observation time of 5 years 37 % are alive free from recurrences and 58 % are dead; 5 % show signs of recurrence.

### *2. Pre- and post-operative treatment*

The ultimate results of the pre-operative cases after an observation time of 5—7 years after commencement of treatment will be evident from table IV which has been arranged in the same way as the corresponding table in the previous therapeutic group.

Out of the 8 cases belonging to group I 6 are found on re-examination to be free from recurrences while 2 have died of cancer 3—6 years after the commencement of treatment.

Of the 31 cases belonging to group II 11 are alive free from recurrences. 3 cases are alive with recurrences of cancer, all after having been under observation for more than 6 years after commencing treatment. 16 cases have died of cancer less than 4 months to more than 4 years after treatment. One case died immediately after the operation of some post-operative complication.

Out of the 6 cases belonging to group III one is still alive free from recurrences, 2 are alive with signs of cancer while 3 have died of cancer from less than 1 year to 3 years after the commencement of treatment.

The final result for all the cases belonging to the pre-operative group is thus that 18 cases of 45, or 40 % are alive free from recurrences, 5 cases or 11 % are alive with signs of cancer and 21 cases or 46.7 % have died of cancer.

**Table IV**

*Cases treated by pre-operative radiation, operation and post-operative radiation*

| Duration of life after commencement of treatment | Free from symptoms | | | | Still alive with symptoms of cancer | | | | Dead from cancer | | | | Dead from i. d. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | I | II | III | Total | I | II | III | Total | I | II | III | Total | I | II | III | Total | |
| < 1 year | | | | | | | | | | 3 | 2 | 5 | | 1 | | 1 | |
| 1—2 yrs | | | | | | | | | | 6 | | 6 | | | | | |
| 2—3 yrs | | | | | | | | | | 3 | | 3 | | | | | |
| 3—4 yrs | | | | | | | | | 1 | 2 | 1 | 4 | | | | | |
| 4—5 yrs | | | | | | | | | | 2 | | 2 | | | | | |
| 5—6 yrs | 1 | 6 | 1 | 8 | | | 2 | 2 | | | | | | | | | |
| 6—7 yrs | 2 | 5 | | 7 | | 3 | | 3 | 1 | | | 1 | | | | | |
| > 7 yrs | 3 | | | 3 | | | | | | | | | | | | | |
| **Total** | **6** | **11** | **1** | **18** | | **3** | **2** | **5** | **2** | **16** | **3** | **21** | | **1** | | **1** | **45** |
| | | | | 40 % | | | | 11 % | | | | 46.7 % | | | | 2.3 % | |

After an observation time of 3 years 59 % are free from recurrences and 35 % are dead and after an observation of 5 years the figures are 50 % and 46.7 % respectively.

### *3. Treatment by electro-endothermy and radiation*

The result of this method of treatment will be clear from table V and chart 3, both being arranged in the same way as the tables and charts in the post- and pre-operative cases.

**Table V**

*Cases treated by radiation and electro-endothermy*

| Duration of life after commencement of treatment | Free from symptoms | | | | Still alive with symptoms of cancer | | | | Dead from cancer | | | | Dead from i. d. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | I | II | III | Total | I | II | III | Total | I | II | III | Total | I | II | III | Total | |
| < 1 year | | | | | | | | | | | 5 | 5 | | 1 | 1 | 2 | |
| 1—2 yrs | | | | | | | | | | | 5 | 5 | | | 1 | 1 | |
| 2—3 yrs | | | | | | | | | | 4 | 6 | 10 | | | | | |
| 3—4 yrs | | | | | | | | | | | 3 | 3 | | | | | |
| 4—5 yrs | | | | | | | | | | | | | | | | | |
| 5—6 yrs | | 3 | 2 | 5 | | | | | | 1 | | 1 | | | | | |
| 6—7 yrs | 2 | 2 | 1 | 5 | | 1 | 1 | 2 | | 1 | | 1 | | | | | |
| > 7 yrs | | 1 | 1 | 2 | | | | | | | | | | | | | |
| Total | **2** | **6** | **4** | **12** | | **1** | **1** | **2** | | **6** | **19** | **25** | | **1** | **2** | **3** | **42** |
| | | | | 28.8 % | | | | 4.7 % | | | | 59.7 % | | | | 7 % | |

The two cases belonging to Steinthal's group I are alive free from recurrence more than 6 years after commencement of treatment.

Of the 14 cases belonging to group II 6 are alive free from recurrence more than 5 years after commencing treatment, one case is alive with signs of cancer more than 6 years after commencing treatment, 6 cases have died of cancer from 2 to 6 years after the commencement of treatment, and one case, lastly, died in connection with the treatment of thrombophlebitis.

Of the 26 cases belonging to group III 4 are alive free from recurrence after more than 5 years, one is still alive after more than 6 years with signs of cancer, 19 cases have died of cancer less than six months to more than 3 years after the operation, 2 cases are dead from intercurrent disease, one from pneumonia immediately after the operation and one from cerebral haemorrhage more than 1 year after the treatment.

Detroit Public Library
Medical Science Department.



4 of the 26 cases belonging to group III were quite inoperable on account of distant metastases and large, fixed, ulcerated tumours and in these cases it was found impossible to remove the primary growth. The indication for operation here was to try to relieve the patient from a septic and foetid disintegration of the tumour. These 4 cases were only temporarily improved; in three of the cases, however, the tumorous remnants grew in size after a short time, the patients succumbing within the course of six months. The fourth case lived for more than a year.

The final result obtained for the whole material treated by electro-endothermy and irradiation is thus: on after-examination 21 cases of 42 or 28.6 % are alive free from recurrence, 2 or 4.5 % are alive with signs of cancer more than 6 years after commencing treatment and 25 cases or 59.7 % have died of cancer. If eliminating the 4 cases in which only a temporary, purely local, palliative effect was aimed at by the treatment, the figure is 31.5 % free from recurrence.

After an observation time of 3 years 43 % are alive, 53 % are dead and 4 % show signs of recurrence. After an observation time of 5 years the corresponding figures are 33 %, 64 % and 3 %.

### 4. *Only radiological treatment*

The final result of this method of treatment is stated in table VI which has been arranged in the same way as in the corresponding tables in the other therapeutic groups.

**Table VI**

*Cases treated by radiation only*

| Duration of life after commencement of treatment | Free from symptoms | | | | Still alive with symptoms of cancer | | | | Dead from cancer | | | | Dead from i. d. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | I | II | III | Total | I | II | III | Total | I | II | III | Total | I | II | III | Total | |
| < 1 year | | | | | | | | | | 1 | 12 | 13 | | | | | |
| 1—2 yrs | | | | | | | | | | 1 | 2 | 3 | | | | | |
| 2—3 yrs | | | | | | | | | | | 4 | 4 | | | | | |
| 3—4 yrs | | | | | | | | | 1 | | | 1 | | | | | |
| 4—5 yrs | | | | | | | | | | | | | | | | | |
| 5—6 yrs | | | | | | | | | | | | | | | | | |
| 6—7 yrs | 1 | | | 1 | | | | | | | | | | | | | |
| > 7 yrs | | | | | | | | | | | | | | | | | |
| Total | 1 | | | 1 | | | | | 1 | 2 | 18 | 21 | | | | | 22 |

Of the 2 cases belonging to Steinthal's group I 1 is free from recurrence after having been under observation for more than 6 years, the second case died of cancer more than 3 years after commencement of treatment.

The 2 cases belonging to group II both died of cancer within the course of two years.

All cases belonging to group III have died of cancer of which more than half within the course of the first year after commencing treatment.

The final result of the whole material in this group is that one case of 22 or 4.5 % is on re-examination alive free from recurrence. On account of the limited number of cases and their poor condition, this group offers little interest for comparison with the other therapeutic groups.

### 5. *Treatment of recurrences and metastases after the operation*

Table VII shows the result on re-examination of the treatment of recurrences and metastases during the 3-year period 1921—1923. This table has been arranged in a similar manner as previous tables, and it further gives us information of the result of treatment of local recurrences and distant metastases.

Of the 18 cases presenting only local recurrences 4 or 22.2 % are alive and free from symptoms on re-examination, more than 5 years after commencing treatment.

**Table VII**

*Recurrences and metastases after operation treated only radiologically*

| Duration of life after commencement of treatment | Free from symptoms- | | | | Still alive with symptoms of cancer | | | | Dead from cancer | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Local | Distant metast. | Loc. & metast. | Total | Local | Distant metast. | Loc. & metast. | Total | Local | Distant metast. | Loc. & metast. | Total |
| < 1 year . | | | | | | | | | 6 | 12 | 8 | 26 |
| 1—2 yrs . | | | | | | | | | 3 | 8 | 11 | 22 |
| 2—3 yrs . | | | | | | | | | 3 | 3 | 1 | 7 |
| 3—4 yrs . | | | | | | | | | 1 | 2 | 1 | 4 |
| 4—5 yrs . | | | | | | | | | 1 | 1 | | 2 |
| 5—6 yrs . | 3 | 1 | | 4 | | | | | | 1 | 1 | 2 |
| 6—7 yrs . | 1 | 1 | | 2 | | | | | | | | |
| > 7 yrs . | | 1 | | 1 | | 1 | | 1 | | | | |
| **Total** | **4** | **3** | | **7** | | **1** | | **1** | **14** | **27** | **22** | **63** |
| | | | | 9.8 % | | | | 1.5 % | | | | 88.7 % |

Of the 22 cases showing signs of local recurrences as well as distant metastases none are alive on re-examination; all are dead less than 1 year to 5 years after commencement of treatment.

Of the 31 cases only showing signs of distant metastases 3 or 9.7 % are alive on re-examination, 1 case is still alive with signs of cancer.

The final result of all the cases, local recurrences as well as distant metastases, is thus that 7 cases of 71 or 9.8 % are alive, free from symptoms, more than 5 years after commencing the treatment of the recurrences.

### 6. *Comparison between the final result after combined surgical and radiological treatment and the result after only operative treatment*

It is of great interest in the first place to compare the results obtained after a combined surgical and radiological treatment with that obtained after operation alone. In table VIII have been collected the result of the operative treatment of cancer mammae such as it appears from the latest statistics in Sweden. The 5-year cure-rate varies according to these statistical investigations between 15 and 25.5 %. In his extensive statistics NYSTRÖM has found a 5-year freedom of recurrence of at least 20 and at the most 23 %.

**Table VIII**

*The percentage of 5-year healings by surgical treatment of cancer of the breast in Sweden*

| Author | Free from recurrences after 5 year |
|---|---|
| DAHLGREN | 15 % |
| NEANDER | 16.8 % |
| BRATTSTRÖM 1898—1915 | 23 % |
| » 1905—1915 | 25.5 % |
| NYSTRÖM | 20–23 % |

In table IX a comparison has been made between the results obtained by surgical treatment only and that obtained by combined surgical and radiological treatment. While the highest figure for the surgical cases is 25.5 %, this tabulation shows a cure-rate of 29.3 % in the post-operative cases and 40 % in the pre-operative cases. It will be clear, therefore, that a 5-years healing result occurs at a higher rate and that the recurrences are less frequent after a combined surgical and radiological treatment than after surgical treatment only. This improvement of the

results is very much in evidence after a pre- and postoperative radiological treatment.

**Table IX**

*The percentage of 5-year healings by different methods*

| Only operation (NYSTRÖM) | Op. and post-op. radiation | Op. and pre- and post-op. radiation | Electro-endothermy and radiation |
|---|---|---|---|
| 20—23 % | 29.3 % | 40 % | 28.6 % |

It is further of great interest to compare the final result obtained by electro-endothermy combined with radiotherapy with the other therapeutic methods, particularly cases treated by ordinary radical operation combined with radiotherapy.

Although the quality of the material in the endothermic group is much inferior to that of the other therapeutic groups the endothermic group shows a freedom of recurrence after 5 years' observation in 28.6 %, thus about the same result as obtained in the post-operative group.

The pre-operative and endothermic groups show a considerably better result in the prognostically more unfavourable cases corresponding to Steinthal's group II and III than the post-operative group; this will be clearly seen in table X.

**Table X**

*The rate of 5-year healings in the different Steinthal's groups by the different methods of treatment*

| | Op. and post-op. radiation | Op. and pre- and post-op. radiation | Electro-endothermy and radiation |
|---|---|---|---|
| Group I . . . . . | 6 : 10 | 6 : 8 | 2 : 2 |
| Group II . . . . . | 16 : 55 | 11 : 31 | 6 : 14 |
| Group III . . . . . | 0 : 10 | 1 : 6 | 4 : 26 |

It will also be clear from this table that the best results in cases belonging to Steinthal's group I are obtained in the pre-operative group. The cases belonging to the endothermic group are far too few to allow of any conclusion in this respect as to the value of this therapeutic method.

## The Result of the Treatment as Apparent from the Frequency of Recurrence and Metastases

### *1. The time of appearance of recurrences and metastases*

In most cases it is quite impossible to say when exactly a recurrence first appears; particularly does this hold good for the internal metastases. Thanks to the fact, however, that the patients at Radiumhemmet are subjected to a careful re-examination every other month during the first year after commencing treatment and during the next few years every second or third month and subsequently at least a couple of times in the year, even when free from symptoms, there is nevertheless a possibility of ascertaining with relative certainty the approximate time of the first appearance of a recurrence.

Of the 75 cases treated post-operatively 50 or 66.7 % have shown signs of recurrences or metastases. Out of these 2 have later, after combined surgical and radiological treatment, been rendered free from symptoms. In both cases there was a question of local recurrence. In one of the cases the recurrence reappeared after 2 years, in the other after 5 years.

Extirpation was performed in both cases by electro-endothermy and subsequently treatment by radium was adopted.

In table XI will be found the time of occurrence of the different recurrences or metastases in the post-operative cases. All the local recurrences have appeared during the first 4 years after commencement of treatment. Out of the 19 local recurrences no less than 11 or 59.9 % have appeared during the first 6 months and 13 or 68.5 % during the first year. The distant metastases on the other hand have been manifest from less than 6 months to more than 7 years. Out of the 26 distant metastases 8 or 30.8 % have appeared during the first year and 15 or 57.7 % during the first two years. Out of the 5 cases with signs of local recurrences as well as distant metastases, all have appeared during the first 3 years. Out of all 50 cases of recurrences and metastases 13 or 26 % appeared within the course of the first six months after the operation. After one year 21 cases or 42 % have shown signs of recurrences or metastases and after 2 years 35 cases or 70 %. In 6 cases no metastases occurred until after more than 5 years. It will be found, therefore, that of cases with recurrences and metastases not quite half the number occurred during the first year after treatment and not quite three-fourths within the course of two years.

The average length of time before recurrences and metastases appeared in the post-operative cases was 1 year and 9 months.

Of the 45 cases treated pre-operatively 27 cases have shown recurrences or metastases a longer or shorter time after the operation, from

**Table XI**

*The appearance of recurrences and metastases in cases treated with operation and post-operative radiation*

| Duration op.-rec. | Number of recurrences and metastases | | | | |
|---|---|---|---|---|---|
| | Rec. | Metastases | Rec. and metastases | Total | Per cent |
| < 6 mths | 11 | 2 | | 13 | 26 |
| 6—12 mths | 2 | 6 | | 8 | 16 |
| 1—2 yrs | 3 | 7 | 4 | 14 | 28 |
| 2—3 yrs | 2 | 1 | 1 | 4 | 8 |
| 3—4 yrs | 1 | 3 | | 4 | 8 |
| 4—5 yrs | | 1 | | 1 | 2 |
| 5—6 yrs | | 1 | | 1 | 2 |
| 6—7 yrs | | 2 | | 2 | 4 |
| > 7 yrs | | 3 | | 3 | 6 |
| Total | 19 | 26 | 5 | 50 | |

Average 21 months.

only a few months to more than 7 years afterwards. One of these cases was subsequently healed by roentgen treatment and still five years later no signs of cancer were found on re-examination. This case had an obvious gland which clinically indicated metastasis. This was found about three months after the operation and was then treated by roentgen.

**Table XII**

*The appearance of recurrences and metastases in cases treated with pre- and post-operative radiation*

| Duration op.-rec. | Number of recurrences and metastases | | | | |
|---|---|---|---|---|---|
| | Rec. | Metastases | Rec. and metastases | Total | Per cent |
| < 6 mths | 3 | 2 | | 5 | 18,6 |
| 6—12 mths | 3 | 1 | | 4 | 14.8 |
| 1—2 yrs | 2 | 6 | | 8 | 29.6 |
| 2—3 yrs | | 2 | | 2 | 7.4 |
| 3—4 yrs | | 1 | | 1 | 3.7 |
| 4—5 yrs | | 3 | | 3 | 11.1 |
| 5—6 yrs | | 2 | | 2 | 7.4 |
| 6—7 yrs | | 2 | | 2 | 7.4 |
| > 7 yrs | | | | | |
| Total | 8 | 19 | | 27 | |

Average 28 months.

In table XII will be found stated the time of appearance of the recurrences and metastases as well as their location. Here too all the local recurrences have appeared at an early time after commencement of treatment. All the 8 cases of local recurrences have then been apparent during the first two years, while the distant metastases have been manifest from less than 6 months to 7 years. Out of all cases of local recurrences and distant metastases, in all 27, 5 or 18.5 % have had recurrences or metastases within the course of the first six months after the operation. After 1 year 9 cases or 33.3 % have had recurrences or metastases and after 2 years 17 cases or 63 %. First within the course of the third year have recurrences or metastases appeared in as much as 74.1 %. In no less than 6 cases have metastases appeared after more than 5 years. In half the number of cases, therefore, did recurrences or metastases appear within the course of the second year after operation and in three-fourths first after 4 years.

The average time of appearance of recurrences and metastases in the pre-operative cases is 2 years and 4 months.

In table XIII will be found the time of appearance of the different recurrences and metastases in cases treated by electro-endothermy. Within brackets will also be found those cases in which the tumour has not been radically removed.

**Table XIII**

*The appearance of recurrences and metastases in cases treated with radiation and electro-endothermy*

| Duration op.-rec. | Number of recurrences and metastases | | | | |
|---|---|---|---|---|---|
| | Rec. | Metastases | Rec. and metastases | Total | Per cent |
| < 6 mths . . . . . | 0 (3) | | 1 | 1 (4) | 4.2 |
| 6—12 mths . . . . . | | 4 | | 4 | 16.6 |
| 1—2 yrs . . . . . | | 8 | | 8 | 33.3 |
| 2—3 yrs . . . . . | 1 | 5 | | 6 | 25 |
| 3—4 yrs . . . . . | 1 | 2 | | 3 | 12.5 |
| 4—5 yrs . . . . . | | 1 | | 1 | 4.2 |
| 5—6 yrs . . . . . | | | | | |
| 6—7 yrs . . . . . | | 1 | | 1 | 4.2 |
| Total | 2 (5) | 21 | 1 | 24 (27) | |

Average 25.5 (23) months.

In one case or 4.2 % the recurrence has appeared within the course of the first six months. Five cases or 21 % have shown recurrences or metastases within the course of one year and within the course of the second year recurrences or metastases appeared in still another 8 cases or altogether 54 %. At the end of the third year of observation, further

recurrences and metastases had appeared in 3 cases or altogether 79 %. In one case the cancer recurred after more than 5 years. The two local recurrences have appeared 2—4 years after commencement of treatment.

After one year, therefore, a little more than one-fifth of the recurrences and metastases have appeared. Somewhat more than half the number have appeared within the course of two years and somewhat more than three-fourths after 3 years.

The average time of appearance for cases treated by electro-endothermy and radiotherapy is 2 years and $1^1/_2$ months.

According to NYSTRÖM's statistical investigation of 121 cases of recurrences and metastases appearing after ordinary radical operation, 59 or 49 % have occurred within the course of the first six months after the operation. Within the course of the following six months another 34 tumours have recurred or altogether 77 % within the course of one year. Three cases have recurred after more than 5 years. Late local recurrences are not so very rare after surgical treatment. Of the reported cases of recurrences after operation NYSTRÖM has found many late (more than 5 years) recurrences and metastases, in all 21 cases, 10 of these were local recurrences.

In half the number of cases, therefore, the recurrences and metastases appear within the course of the first six months and in three-fourths within the course of the first year after the operation, in cases only subjected to radical operation.

The recurrences and metastases in cases solely treated by operation in NYSTRÖM's statistics appeared on an average 9 months after the operation.

In comparing these different results it will thus be found that local recurrences after the combined treatment have appeared during the first years after commencement of treatment and that the average time of the

**Table XIV**

*The appearance of recurrences and metastases by different treatments*

| Time after op. | Only operation (NYSTRÖM) 121 cases | Op. and post-op. radiation 50 cases | Op. and pre- and post-op. radiation 27 cases | Electro-endothermy and radiation 24 cases |
|---|---|---|---|---|
| < 6 mths . . . . . | 59 (48.8 %) | 13 (26.0 %) | 5 (18.5 %) | 1 (4.2 %) |
| 1 yr . . . . . | 93 (76.9 %) | 21 (42.0 %) | 9 (33.3 %) | 5 (20.8 %) |
| 2 yrs . . . . . | 110 (90.9 %) | 35 (70.0 %) | 17 (63.0 %) | 13 (54.2 %) |
| 3 yrs . . . . . | 115 (95.0 %) | 39 (78.0 %) | 19 (70.4 %) | 19 (79.2 %) |
| 5 yrs . . . . . | 118 (97.5 %) | 44 (88.0 %) | 23 (85.1 %) | 23 (95.8 %) |
| > 5 yrs . . . . . | 121 (100.0 %) | 50 (100.0 %) | 27 (100.0 %) | 24 (100.0 %) |
| Average | 9 mths | 21 mths | 28 mths | 25.5 mths |

appearance of the local recurrences do not differ to any great extent from the average time of those after surgical treatment alone. The distant metastases after the combined treatment have on the other hand shown a tendency towards a later appearance than those after the surgical treatment. There is thus a much longer interval before any signs of metastases appear in those cases where the operation has been combined with radiological treatment than in those cases only surgically treated.

### 2. *The location of the recurrences and metastases*

It is of importance for estimating the value of the radiological treatment to know of the rate of local recurrences as well as distant metastases. By local recurrences we mean, in this relation, cancer appearing within the operation field, and by distant metastases all cancer appearing outside the operation field itself. In the term distant metastases we include, therefore, also glandular and internal metastases.

In 26 cases or 52 % out of the 50 in which recurrences or metastases appeared after the post-operative treatment there have been only distant metastases. In 19 cases or 38 % local recurrences only have been present. In 5 cases or 10 % there have been local as well as distant metastases.

In the pre-operative cases 8 of the 27 or 29.6 % have shown local recurrences. All of them appeared within the course of the first two years after the operation. In the remaining 19 cases or in 70.4 % there have been only distant metastases.

In the endothermic group two cases out of 24 or 8.3 % have shown signs of local recurrences, arisen 2—4 years after the commencement of treatment. In one case or 4.2 % there were local recurrences as well as metastases. In the remaining 21 cases or 87.5 % there were only distant metastases.

According to NYSTRÖM's investigations there are signs of distant metastasis in 44.3 % of cases only surgically treated. Local recurrences are found in 25.2 % of the cases while local recurrences and distant metastases occur in 30.5 %.

**Table XV**

*The location of the recurrences and metastases after the different methods of treatment*

| | Only operation (NYSTRÖM) | Op. and post-op. radiation | Op. and pre- and post-op. radiation | Electro-endothermy and radiation |
|---|---|---|---|---|
| Distant metastases . . | 44.3 % | 52 % | 70.4 % | 87.5 % |
| Local rec. . . . . | 25.2 % | 38 % | 29.6 % | 8.3 % |
| Loc. rec. & distant met. | 30.5 % | 10 % | | 4.2 % |

In comparing, therefore, the location of the recurrences and metastases after the different therapeutic methods it will be found, as appears from table XV, that in those cases solely treated surgically, local recurrences appear at a considerably higher rate than in those cases in which the operation has been combined with radiotherapy. In particular is this the case in regard to cases treated pre-operatively. It is clearly evident then, that local recurrences appear more rarely after combined surgical and radiological treatment than after radical operation only.

This finding has probably an influence upon those previously mentioned concerning the lessened frequency of the recurrences and metastases.

### 3. *Interval from operation till death and from the first inception of disease till death*

On examination of the figures in table III—V of the cases, who die of cancer, it will be found that the relatively greatest number of cases have died during the first year after termination of treatment. The death rate subsequently rises more slowly but continues to rise after 5 years.

The interval between operation and death is on an average 2 years and 7 months in the post-operative cases. In this computation those have been included which on re-examination are still alive with signs of cancer. The length of life in these cases has been estimated to be a further six months from the time of re-examination.

In the pre-operative cases the corresponding interval is an average of 3 years and 5 months and in the endothermic cases 3 years and 1 month.

NYSTRÖM's cases, only surgically treated, show an average interval of 1 year and 11 months. If looking for a corresponding figure for the recurrences after operation treated at Radiumhemmet during the time of this re-examination it will be found to be 2 years and 2 months.

If now comparing these results it will be found that, as will be clear from table XVI, cases subjected to a combined radiological and surgical treatment live on an average considerably longer after the operation than those treated only by operation.

**Table XVI**

*Average interval from first operation to death in cases dead from cancer*

| Only operation (NYSTRÖM) | Rec. and metastases treated after operation by radiation | Op. and post-op. radiation | Op. and pre- and post-op. radiation | Electro-endothermy and radiation |
|---|---|---|---|---|
| 23 mths | 26 mths | 31 mths | 41 mths | 37 mths (31 mths) |

Notwithstanding the fact that the cases of the endothermic group are of a much worse quality than the other therapeutic groups, they live considerably longer than the post-operative cases.

That the cases of recurrences treated radiologically live longer than cases of recurrences not treated radiologically also shows that the radiological treatment is of great palliative importance.

**Table XVII**

*Average interval from first appearance of symptoms of cancer to death*

| No treatm. (NYSTRÖM) | Only op. (NYSTRÖM) | Radiol. treat. recurrences and metastases | Op. and post-op. radiation | Op. and pre- and post-op. radiation | Electro-endothermy and radiation |
|---|---|---|---|---|---|
| 31 mths | 39 mths | 46 mths | 49 mths | 61 mths | 67 mths |

The interval from the first sign observed till death is shown in these therapeutic groups to be — see table XVII — for the post-operative cases 4 years and 1 month, for the pre-operative groups 5 years and 1 month and for the endothermic cases 5 years and 7 months.

**Table XVIII**

*Average duration from first appearance of symptoms of cancer to treatment in cases of recurrences and metastases*

| Rec. and metastases treated after operation by radiation | Op. and post-op. radiation | Op. and pre- and post-op. radiation | Electro-endothermy and radiation |
|---|---|---|---|
| 20 mths | 18 mths | 20 mths | 30 mths |

The duration of the disease before operation in those cases presenting recurrences is longer in all these therapeutic groups than for all the material; this will be clear by comparing tables XVIII and II. For this interval is shown to be 3 months longer for the recurrences in the post- and pre-operative cases than for the whole material, while the corresponding figure for the endothermic cases is 6 months. The duration of disease before operation in the cases treated by surgery only is also 3 months longer in the recurrent cases than in the others.

According to NYSTRÖM's statistics the cases solely operated upon show an average duration from the first sign of disease till death of 3 years and 3 months. LUCAC in Switzerland has carried out an investigation similar to NYSTRÖM. He has thus found the average duration of operated cancer mammae from the first sign of disease till death to be 2 years and 10.6 months, thus a little shorter than that found by NYSTRÖM.

It is of great interest that NYSTRÖM found the average duration for the non-operated cases of cancer mammae to be 2 years and 7 months while LUCAC found the corresponding figure to be 2 years and 5.8 months.

According to NYSTRÖM's investigations, therefore, the operated cases live on an average 8 months longer than the non-operated cases; LUCAC found that the operated cases live about 5 months longer than the non-operated cases. It is clear, therefore, that according to these two investigators the operated cases live slightly longer than the non-operated cases of cancer mammae.

The result of this investigation shows that the cases treated by combined radiological and surgical methods live considerably longer than the cases only treated surgically. It would seem, therefore, as if the combined treatment had a greater palliative effect than the surgical.

## The Main Result of the Investigation

The result of this comparison between cases of cancer mammae treated by operation alone and those in which the operation has been combined with radiological treatment, is as follows:

A 5-year freedom from symptoms is obtained in a greater number of cases and the percentage of recurrences and metastases is lower after a combined surgical and radiological treatment than after operation only. Furthermore there arise much fewer local recurrences after the combined treatment. The interval before any signs of local recurrence appear after the combined treatment is about the same as after the surgical treatment. On the other hand there is a very much longer interval before the distant metastases are manifest in cases treated with radiation and surgery than in those treated with surgery alone.

The duration of life in cases who die of cancer, after appearance of the first sign of cancer and after the commencement of treatment, is considerably longer after the combined therapy than after surgical treatment only. This observation will become still more obvious by comparing the duration of life in non-treated cases partly with those treated surgically only, and partly with those treated surgically and radiologically. The difference will not be found to be greater than $^1/_2$—$^3/_4$ years between non-treated and surgically treated cases, while the difference between non-treated cases and those treated surgically and radiologically will be found to be $2^1/_2$ years.

The recovery is therefore more permanent and more satisfactory for the cases radiologically and surgically treated than in those solely treated by surgery. This result is still further augmented by treating the cases pre- and post-operatively as compared with those treated only by post-operative radiation.

It is also of great interest to note that at Radiumhemmet we have obtained such relatively good results by the combined method of electro-endothermy and irradiation especially in the prognostically unfavourable cases.

True that the number of cases is not large enough to justify absolute conclusions as regards the value of the combined treatment. Yet the question has been judged from many different points of view and a concordant result obtained. As, moreover, these results in many cases are obvious enough, they would seem to make up to some extent for the relative scarcity of cases.

If further, comparing the results brought to light by this investigation, obtained by the surgical and radiological combined therapy in cancer mammae with those obtained by FORSSELL by only radiological treatment of malignant tumours with regard to the permanency of the healing, a great many points of interest will be found. According to these investigations the frequency of recurrence after a radio-healing is lower than after primary surgical healing in most of the tumours that offer a fair chance of obtaining a primary radio-healing.

## SUMMARY

The investigation includes all cases of cancer mammae, 307 cases in all, that applied for treatment at Radiumhemmet during the period 1921—1923. Of these 52 cases were not treated. 162 cases have been given combined surgical and radiological treatment. Out of these 162 cases 75 have had post-operative radiological treatment, 45 have had radiological treatment before as well as after the operation and in 42 cases the radiological treatment has been combined with removal of the tumour by electro-endothermy. 22 cases of primary cancer have been treated only radiologically. The remaining 71 cases have on their admission to Radiumhemmet shown signs of recurrences or metastases and been treated radiologically. All the cases but 2 have been examined several times a year until their death or in the cases still alive, until the end of 1928.

To get some idea of the value of the radiological treatment I have compared the results obtained at Radiumhemmet with those obtained by surgical treatment of cancer mammae in Sweden.

The result of this comparison, as between cases of cancer mammae only treated by operation and those where the operation has been combined with radiological treatment, is as follows:

In cases treated surgically and radiologically a 5-year freedom from symptoms is obtained in a relatively greater number of cases. The surgical statistics in Sweden show a 5-year freedom from symptoms in 16.8—25.5 per cent of the cases. The cases treated post-operatively show a corresponding freedom from sympto s in 29.3 %, those treated pre-operatively in 40 %. The endothermic cases v ich in this investigation are of a much worse nature show a freedom from sy iptoms in 28.6 %.

The radiologically treated recurrences and metastases show freedom of symptoms in 9.8 % of the cases after a period of observation lasting more than 5 years.

The interval before any signs of local recurrence appear after the combined treatment is about the same as after the surgical treatment. On the other hand there is a very much longer interval before the distant metastases are manifest in cases treated with radiation and surgery than in those treated with surgery alone.

The local recurrences occur much less frequently after the combined treatment than after surgical treatment alone. After surgical treatment 55.7 % of the recurrences are of local nature. The post-operative group shows 48 % local recurrences, the pre-operative group 29.2 % and the endothermic group 12.5 %.

The duration of life after the appearance of the first symptom and after the commencement of treatment is in cases, who die of cancer, much longer after the combined therapy than after surgical treatment. Cases only operated upon have lived on an average 39 months after the appearance of the first symptom and 23 months after the first treatment, the cases treated post-operatively 49 and 31 months respectively, the pre-operative cases 61 and 41 months and the endothermic cases 67 and 37 months respectively. In comparison it may be mentioned that non-treated cases of cancer mammae live for an average of 31 months after the appearance of the first symptom.[1]

## ZUSAMMENFASSUNG

Die Zusammenstellung umfasst alle Fälle von Cancer mammae, insgesamt 307 an der Zahl, die in den Jahren 1921—1923 am Radiumhemmet Hilfe gesucht hatten. Bei 52 von diesen Fällen wurde keine Behandlung vorgenommen. Von den übrigen 255 Fällen wurden 162 Fälle einer kombinierten chirurgischen und radiologischen Behandlung unterzogen. Von diesen 162 Fällen wurden 75 postoperativ radiologisch behandelt, 45 Fälle sowohl vor wie nach der Operation bestrahlt, und in 42 Fällen war die radiologische Behandlung mit Entfernung des Tumors durch Elektroendothermie kombiniert. 22 Fälle von primärem Cancer mammæ und 71 Fälle, die bei der Aufnahme ins Radiumhemmet Zeichen von Rezidiven und Metastasen aufwiesen, wurden nur rein radiologisch behandelt. Alle Fälle, ausser 2, wurden jährlich mehrere Male untersucht, die letal verlaufenen bis der Tod eintrat, und die Fälle, die weiterhin leben, bis Ende des Jahres 1928.

Um eine Vorstellung über den Wert der radiologischen Behandlung zu bekommen, verglich Verf. die am Radiumhemmet gewonnenen Resultate mit denjenigen, die bei chirurgischer Behandlung von Cancer mammae in Schweden erreicht wurden.

Dieser Vergleich zwischen den Fällen von Cancer mammae, bei welchen die Behandlung rein operativ war, und denen, wo die Operation mit radiologischer Behandlung kombiniert worden war, ergibt folgendes Resultat:

Bei den auch radiologisch behandelten Fällen erhielt man in einer relativ grösseren Anzahl eine 5jährige Symptomfreiheit. Die chirurgischen Statistiken in Schweden weisen in 16.8—25.5 % der Fälle eine 5jährige Symptomfreiheit auf. Eine gleich lange Symptomfreiheit zeigen von den postoperativ behandelten Fällen 29.3 %, von den präoperativ Behandelten 40 %, von den Endothermiefällen — diese Fälle waren prognostisch bedeutend schlechter beschaffen — 28.6 %.

Von den behandelten Rezidivfällen und Metastasen waren 9.8 % nach einer mehr als 5jährigen Beobachtungszeit symptomfrei.

Das Intervall, bevor Zeichen lokalen Rückfalles nach der Kombinationstherapie erscheinen, ist ungefähr dasselbe wie nach der chirurgischen Behandlung. Anderseits ist das Intervall viel grösser, bevor die Fernmetastasen sich mani-

festieren, in Fällen, die mit der Kombinationstherapie behandelt sind, als in denen, die nur chirurgisch behandelt sind.

Die lokalen Rezidiven kommen nach der Kombinationstherapie in viel geringerer Anzahl vor als nach ausschliesslich chirurgischer Behandlung. Nach der letzteren sind 55.7 % der Rezidiven Lokalrezidiven. Die postoperative Gruppe weist 48 % Lokalrezidiven auf, die präoperative Gruppe 29.2 %, und die Endothermiegruppe 12.5 %.

Die Lebensdauer von der Beobachtung der ersten Symptome an, wie vom Beginn der Behandlung an, ist in Fällen, die in Kanzer sterben, nach der Kombinationstherapie bedeutend länger als nach ausschliesslich chirurgischer Behandlung. Die nur operierten Fälle lebten im Durchschnitt 39 Monate nach der Beobachtung der ersten Symptome und 23 Monate nach der ersten Behandlung, die postoperativ behandelten Fälle 49 resp. 31 Monate, und die präoperativ behandelten Fälle 61 resp. 41 Monate, die Endothermiefälle 67 resp. 37 Monate. Zum Vergleich mit diesem kann angeführt werden, dass nicht behandelte Fälle von Cancer mammae im Durchschnitt 31 Monate nach der Beobachtung der ersten Symptome leben.

## RÉSUMÉ

Cet exposé récapitulatif comprend l'ensemble des cas de cancer du sein, 307 en tout, observés à la consultation du Radiumhemmet de 1921 à 1923. Parmi ces cas, 52 n'ont été l'objet d'aucun traitement, et des 255 autres, 162 malades ont été l'objet d'un traitement mixte, à la fois radiologique et chirurgical, et parmi eux, 75 ont également suivi un traitement radiologique post-opératoire. Chez 45 malades, on a appliqué un traitement radiologique à la fois pré- et post-opératoire, et dans 42 cas, le traitement radiologique a été combiné avec l'ablation de la tumeur par électro-endothermie. 22 malades de cancer primaire du sein et 71 malades, qui présentaient, à leur entrée au Radiumhemmet, des signes de récidive ou de metastases, ont subi un traitement radiologique seulement. Tous les malades ci-dessus, sauf deux, ont été ultérieurement examinés plusieurs fois par an jusqu'à leur mort, ou, pour les cas de survie, jusqu'à la fin de l'année 1928.

Dans le but de permettre une appréciation de la valeur du traitement radiologique, nous avons comparé les résultats atteints au Radiumhemmet avec ceux qu'a donnés en Suède le traitement chirurgical du cancer du sein.

Cette comparaison entre les cas exclusivement traités par opération et ceux où l'intervention à été combinée avec un traitement radiologique permet de faire les constatations suivantes:

Dans les cas ayant également subi un traitement radiologique, on obtient dans une proportion relativement plus grande une suppression des symptômes pendant un délai de 5 ans. Les statistiques chirurgicales suédoises indiquent, pour le même délai, une suppression de tous symptômes dans une proportion de 16.8 à 25.5 % des cas, et de 40 % dans les cas ayant subi un traitement pré-opératoire. Les cas traités par endothermie, qui sont à ce point de vue d'un pronostic notablement plus sombre, donnent une proportion de 28.6 %.

Les récidives et les metastases traitées présentent, au bout d'un délai d'observation de 5 ans, 9.8 % de cas exempts de tous symptômes.

L'intervalle avant, que les signes de récidives locales apparaissent après le traitement combiné, est à peu près la même qu'après le traitement chirurgical. Au contraire il y a un intervalle plus long avant que les metastases à distance se manifestent après une thérapeutique combinée qu'après un traitement exclusivement chirurgical.

Les récidives locales sont notablement moins nombreuses après traitement combiné qu'après traitement exclusivement chirurgical; dans ce dernier cas, 55.7 % des récidives sont des récidives locales. Le groupe post-opératoire ne présente que 48 % de récidives locales, le groupe pré-opératoire 29.2 % et le groupe d'endothermie 12.5 %.

La durée de la survie, comptée à dater de l'apparition du premier symptôme ou du début du traitement est dans les cas mourants de cancer notablement plus longue avec la thérapeutique combinée qu'après la thérapeutique chirurgicale simple. Les cas de cette dernière catégorie ont eu une survie moyenne de 39 mois après l'apparition du premier symptôme et de 23 mois après le début du traitement. Ces chiffres sont respectivement de 49 et 31 mois pour les cas ayant subi un traitement post-opératoire, de 61 et 41 mois dans les cas de traitement pré-opératoire, et de 67 et 37 mois dans les cas traités par endothermie. Signalons, à titre comparatif que les cancers du sein n'ayant été l'objet d'aucun traitement comportent une survie moyenne de 31 mois, postérieurement à l'apparition du premier symptôme.

## REFERENCES


1. Anschütz, W. Bruns Beitr. Bd. CXXXIX. p. 25.
2. Béclère, A. Strahlentherapie XIX. p. 62. 1925.
3. Béclère, A. Strahlentherapie XXI. p. 567. 1926.
4. Berven, E. Nord. Tidskr. f. Terapi XIII. 1917.
5. Berven, E. Acta Rad. X. p. 1. 1929.
6. Borak Wien. Klin. Woch.schr. No. 21. 1926.
7. Brattström, E. Acta Chir. LIII. 1920.
8. Dahlgren, K. P. Hygiea 1899.
9. Edling, L. Acta Rad. I. p. 219. 1921.
10. Forrsell, G. Acta Rad. IX. p. 315. 1928.
11. Forssell, G. Acta Rad. Suppl. 2. 1928.
12. Holfelder, H. Strahlentherapie XXII. p. 667. 1926.
13. Jüngling, O. Strahlentherapie XXII. p. 653. 1926.
14. Larsén, T. and E. Lysholm. Acta Rad. III. p. 8. 1924.
15. Lee, B. Ann. Surg. XXXVIII. 1928.
16. Lehmann Centralbl. f. Chir. no. 7. 1924.
17. Lucac cit. Wolff Die Lehre von der Krebskrankheit IV.
18. Neander, A. Hygiea. 1919.
19. Nyström, G. Kräftsjukdomarna i Sverige, Stockholm. 1922.
20. Perthes, G. Centralbl. f. Chir. jan. 1920.
21. Westermark, N. Acta Rad. III. 1924.
22. Westermark, N. Scand. Arch. f. Physiol. LII. 1927.

(AUS DER RÖNTGENABTEILUNG DER CHIRURGISCHEN UNIVERSITÄTSKLINIK,
DOZENT DR. MED. GÖSTA JANSSON, HELSINGFORS)

# OSTEOCHONDRITIS DISSECANS (KÖNIG) VOM RÖNTGENOLOGISCHEN GESICHTSPUNKT AUS BETRACHTET

von

*Gösta Jansson*

(Mit 45 Figuren, Tabulæ I—IV)

Grossenteils dank der vollendeten Röntgentechnik konnte in den letzten Jahren eine ganz neue Krankheitsgruppe innerhalb der Knochenpathologie abgegrenzt werden. Die krankhaften Veränderungen im Knochensystem, die hiermit gemeint sind (PERTHES', SCHLATTER's, KÖHLER's, KIENBÖCK's Krankheit), werden jetzt unter einem einheitlichen Namen, als Epiphyseonekrosen, zusammengefasst. In den Epiphysen entstehen speziell in den Wachstumsjahren aseptische Knochennekrosen (AXHAUSEN), deren Ursache immer noch unbekannt ist, obwohl man eifrig nach ihr geforscht hat. Viele der Erklärungsversuche, die gemacht worden sind, treffen mit der schon 1888 von KÖNIG aufgestellten Theorie über Osteochondritis dissecans zusammen. Daraus erklärt es sich mehr als zur Genüge, dass die alte Diskussion über diesen Krankheitsbegriff von neuem aufgeflammt ist, und zwar fast mit derselben Intensität wie früher. Zahlreiche Autoren haben in letzter Zeit die Ansicht ausgesprochen, dass die Osteochondritis dissecans zur Gruppe der Epiphyseonekrosen zu rechnen sei, und damit die Berechtigung der KÖNIGschen Theorie bestätigt. Dies hat seinerseits Veranlassung dazu gegeben, dass die Anhänger der traumatischen Ätiologie des Mus articularis ihre Stimmen gegen eine solche Auffassung erhoben haben, und die Debatte ist jetzt in vollem Gang.

Bekanntlich gibt es viele Fälle von Gelenkmäusen — nach mehreren Autoren gilt dies von der überwiegenden Anzahl der Fälle — wo kein Trauma vorangegangen ist, oder wo das Trauma so leicht gewesen ist, dass es offenbar keinen Abriss von den Gelenkflächen verursachen konnte. Die Deutung dieser Fälle ist schwierig gewesen und hat eine Menge Theorien entstehen lassen. Von diesen werden diejenigen nicht berührt

werden, welche sich auf die Zeit vor 1888, wo KÖNIG seine Hypothese aufstellte, beziehen, weil die meisten von ihnen auf einem zu unsicheren Grunde ruhen.

KÖNIG nahm an, dass ein Mus articularis in manchen Fällen spontan durch einen Prozess entstehen kann, den er Osteochondritis dissecans nennt. Dieser Prozess wurde eingeleitet durch eine spontane aseptische Knochennekrose in einem begrenzten Gebiet der Epiphyse bei der Gelenkfläche. Die Nekrose führte zu einer entzündlichen Reaktion in der Umgebung, zu einem dissezierenden Prozess, der die Ablösung des nekrotischen Stückes von der Epiphyse zur Folge hatte. Die tiefstliegende Ursache dieser lokalen Nekrose war KÖNIG unbekannt, und er gab sogar zu, dass ein leichtes Trauma die definitive Ablösung veranlassen könne, meinte aber doch, dass das Trauma allein nicht die Ursache hierzu sein könne; eine notwendige Voraussetzung sei ein vorhergehender pathologischer Prozess in der Epiphyse. Seine Annahmen über das Vorkommen der hier erwähnten krankhaften Veränderungen in der Epiphyse stützte KÖNIG auf folgende Umstände: das Fehlen eines der Art der Läsion entsprechenden Traumas in der Anamnese, die Schwierigkeit, Fremdkörper im Gelenk auch bei Anwendung einer möglichst starken Gewalt experimentell zu erzeugen, die Langsamkeit der Krankheitsentwicklung und schliesslich die histologische Untersuchung, welche das Vorhandensein von Nekrose und Bindegewebsneubildung in der Demarkationszone nachwies.

KÖNIGS temperamentvollster Gegner war BARTH, der erklärte, dass alle Gelenkmäuse auf traumatischem Wege entständen. Das Fehlen eines Traumas in der Anamnese beruhte nach seiner Ansicht ganz einfach auf der Vergesslichkeit des Patienten, was um so leichter zu erklären sei, da die ersten Symptome nach dem Trauma nicht alarmierend zu sein brauchten. BARTH hatte bei seinen histologischen Untersuchungen lebende Knorpelzellen in dem freien Körper konstatiert, was seiner Meinung nach gegen einen Nekrotisierungsprozess im Sinne KÖNIGS sprach. Er hob weiter hervor, dass starke Spannungen in den Ligamenta cruciata und in der Gelenkkapsel zu Absprengungen von den Gelenkflächen führen können.

BARTH war KÖNIGS Antipode, und bald traten mehrere Autoren mit vermittelnden Theorien auf. Resultatlose Versuche, durch eine kräftige Gewalt experimentell freie Gelenkkörper zu erzeugen, bewirkten, dass mancher an dem Trauma als dem alleinherrschenden ätiologischen Moment zu zweifeln begann. Diese Autoren (KRAGELUND, BONCET, BÖRNER, AXHAUSEN, VÖLKER) sind der Ansicht, dass das Trauma allein nicht zu einer definitiven Ablösung des Fragmentes führen kann, sondern dass dazu ein besonderer Prozess erforderlich ist, der vorhergeht und die Loslösung allmählich veranlasst. Auf gründliche experimentelle Stu-

dien gestützt, hat vor allem AXHAUSEN diese Theorie weiterentwickelt, die eine Kombination der extremen Theorien darstellt.

AXHAUSEN hat eine lange Reihe von Untersuchungen über die aseptischen Knochennekrosen ausgeführt und ist zu wertvollen Resultaten auf dem Gebiet der Knochenpathologie gekommen. Auf Grund seiner früheren Arbeiten stellt AXHAUSEN die Theorie auf, dass leichte Traumen oder Kontusionen lokale Nutritionsstörungen und daraus entstehende Nekrose der Gelenkflächen hervorrufen können, worauf eine aseptische Entzündung, Chondritis dissecans, an der Grenze der unbeschädigten Umgebung auftritt. Der letztere Prozess demarkiert und trennt schliesslich die nekrotische Partie ab. Diese Theorie hat AXHAUSEN auf Grund seiner letzter Untersuchungsresultate etwas modifiziert. Hierüber weiter unten.

Durch die Ausführungen AXHAUSENS fühlte sich BARTH aufgefordert, wiederum das Wort zu ergreifen. Er korrigiert seine frühere Theorie, hält aber weiter an seiner Ansicht von dem Trauma als alleinigem ätiologischen Faktor fest. Er gibt zu, dass das Trauma das Stück nicht direkt abzulösen braucht, — dieses kann partiell mit der Gelenkfläche verbunden bleiben und wird erst durch ein späteres Trauma oder bloss infolge der Bewegungen in dem Gelenk definitiv von der Umgebung losgetrennt.

Aus Anlass der vermuteten Nutritionsstörung in den Gelenkflächen, die sogar durch leichte Kontusionen hervorgerufen werden könnte, hat LUDLOFF Untersuchungen über die Vaskularisationsverhältnisse in dem Gelenk ausgeführt. Er hat hierbei zu finden geglaubt, dass bei jungen Leuten der mediale Teil des inneren Femurcondylus von einer kleinen Endarterie nutriert wird, die von der Arteria genu media durch das Lig. cruciat. post. nach der erwähnten Femurpartie läuft. Eine Anspannung des genannten Ligaments über die Norm kann hinreichen, um eine Thrombose in dem Gefäss mit einer lokalen Knochennekrose als Folge zu erzeugen.

Es gibt auch Vertreter (GOETJES, ZIEGNER) der Ansicht dass die blosse Überdehnung der Lig. cruciata zu Abriss und Mausbildung führen kann.

KAPPIS hält einseitig an einer traumatischen Genese fest, u. a. darum, weil er bei der Untersuchung des Mausbettes einen Bluterguss gefunden hat.

NEUMANN und SUTHER weisen auf den früher gehegten Irrtum hin, nur von Knorpelablösung zu sprechen und die Erklärung der Pathogenese der O. d. in Knorpelveränderungen zu suchen, während sich die Nekrose in Wirklichkeit tief in den Knochen hinein erstreckt.

LIECK hat 1922, wahrscheinlich als der erste, die O. d. mit von verschiedenen Autoren, PERTHES, SCHLATTER, KÖHLER, beschriebenen Epi-

physeaffektionen in Verbindung gebracht und fasst diese und die O. d. zu einer einzigen Krankheitsgruppe mit gemeinsamer Genese zusammen. Da in der Regel kein Trauma als Krankheitsursache aufzuspüren ist, betrachtet LIECK diese Affektionen als eine Systemkranheit im Knochensystem, eine Funktionsstörung in den Epiphysen, deren innerste Ursache, wie er annimmt, in hormonalen Störungen liegt.

Wie früher erwähnt, hat AXHAUSEN den hier berührten Fragen ein eingehendes Studium gewidmet. Durch seine Untersuchungen ist die in der Knochenpathologie ausserordentlich wichtige Frage der Knochennekrosen wesentlich aufgeklärt worden. Ganz vor kurzem hat er die Resultate einer langjährigen Arbeit auf diesem Gebiet in einem kurz zusammenfassenden Artikel mitgeteilt, in dem er seinen gegenwärtigen Standpunkt in der O. d.-Frage auf Grund seiner Forschungen präzisiert. Eine ausführlichere Wiedergabe seiner Darlegungen scheint am Platze zu sein.

AXHAUSEN betont, dass man früher die Begriffe Knochennekrose und Knochensequester gleichstellte. Man meinte, dass es keine andere Form von Knochentod gebe als den bei pyogenen Infektionen entstandenen Knochensequester. Indessen kommen im Knochensystem recht oft lokale Knochennekrosen vor, die, ohne von einer eitrigen Infektion begleitet zu sein, zur Abstossung der toten Knochenpartie führen. AXHAUSEN scheidet also zwischen Knochensequester und aseptischer Knochennekrose. Eine Form einer solchen aseptischen Knochennekrose stellt nach AXHAUSEN auch die O. d. dar. Aber die Knochennekrose entsteht hier spontan, nicht durch ein Trauma.

Von den vielen Argumenten, die AXHAUSEN gegen die traumatische Theorie anführt, seien hier folgende erwähnt. Wenn er auf experimentellem Weg einen »Frakturabriss» von dem Femurcondylus erzeugt, heilt derselbe schnell wie eine gewöhnliche Fraktur, wenn er aber auf elektrolytischem Weg kleinere lokale Nekrosen im Knochen hervorruft, entsteht an der Grenze gegen den gesunden Knochen ein langsam verlaufender Prozess, der die nekrotische Partie abtrennt. In seinem histologischen Charakter gleicht dieser Abgrenzungsprozess dem, den man bei O. d. sieht. Ähnliche histologische Bilder hat er auch bei den sog. Epiphyseonekrosen (PERTHES', KÖHLERS, KIENBÖCKS u. a. Krankheit) gefunden. Er fasst daher die O. d. nicht als eine besondere Krankheit auf, sondern als eine etwas modifizierte Form einer Epiphyseonekrose.

Wenn eine begrenzte Knochenpartie in eine aseptische Nekrose übergeht, entsteht nach AXHAUSEN in der gesunden Umgebung ein lebhafter Regenerationsprozess; es tritt eine Markproliferation ein, und das proliferierende Gewebe wächst in die Spongiosaräume hinein, indem es den toten Knochen resorbiert und neuen Knochen aufbaut. Kann dieser Reparationsprozess ungestört fortdauern, so wird das nekrotische Stück

bald durch neugebildeten Knochen ersetzt. Da jedoch die lakunäre Resorption der geschädigten Knochenpartie diese sehr porös und schwach macht, entstehen leicht schon bei den normalen Bewegungen des Gelenkes Impressionsfrakturen und Kompressionsfrakturen in diesem porösen Knochen. Bei fortgesetzter Anwendung des Gelenkes reiben sich die Bruchstücke an einander, wobei die Spongiosabalken bei den Frakturflächen zu feinem Mehl zermahlen werden. Dieser Knochendetritus verstopft die Markräume in der Spongiosa und bildet eine Barriere für die vorwärtsdringenden proliferierenden Markstränge. Hier werden diese gezwungen haltzumachen, und die Resorption und Restitution des toten Knochens wird erschwert. Stattdessen entwickelt sich in der Umgebung ein zellenreiches Bindegewebe, das das Knochenstück allmählich resorbiert. Alles dies ruft einen Abgrenzungsprozess hervor; das nekrotische Stück wird von dem gesunden Teil der Epiphyse durch einen recht breiten Wall geschieden, der aus Bindegewebe und Granulationsgewebe besteht. Hierdurch kommen die Bilder zustande, die wir unter anderem bei Röntgenuntersuchung der Osteochondritis dissecans in deren frühesten Stadien sehen, wo das nekrotische Knochenstück wohlabgegrenzt wie das Ei im Nest noch in dem Bett liegt.

Dass ähnliche aseptische Nekrosen den anderen Epiphyseonekrosen zugrunde liegen, konnte von AXHAUSEN bei histologischer Untersuchung konstatiert werden. Das verschiedene Aussehen, das diese auf den Röntgenbildern haben können, beruht nur auf den verschiedenen Belastungsverhältnissen in den verschiedenen Gelenken. Der nekrotische, spongiöse Knochen sinkt bei Druck leicht zusammen und formt sich je nach der Art und Richtung der Belastung verschieden um. Auch bei Tuberkulose und Lues in dem Knochen entstehen durch Infarktbildung aseptische Knochennekrosen, die sich histologisch ebenso wie die vorerwähnten verhalten können.

Bezüglich der Ursache zu der Entstehung abgegrenzter aseptischer Nekrosen innerhalb des Knochensystems scheint AXHAUSEN zu dem Schluss zu kommen, dass diese durch einen embolischen Infarkt »in einer blanden mykotischen Embolie« entstehen, bei der die Infektion nicht zur Entwicklung gelangt, sondern erstickt wird. Ähnliche anämische, auf embolisch-mykotischem Weg entstandene Infarkte, wie man sie bei Obduktionen oft in verschiedenen parenchymatösen Organen entdeckt, hat man auch innerhalb des Knochensystems beobachtet. Insbesondere hat man solche bei Tuberkulose im Knochen gefunden, wobei diese Nekrosen nur mikroskopisch, aber nicht makroskopisch oder röntgenologisch von gesundem Knochen unterschieden werden konnten.

Die pathologisch-anatomischen Erscheinungen im Gelenk bei O. d. spiegeln sich auch in dem klinischen Bilde wieder. Während des langsam vor sich gehenden Abgrenzungsprozesses, wo sich der künftige

freie Körper noch in dem Bett befindet, woraus er im Begriff ist sich zu lösen, wird der Patient von schwachen »rheumatischen« Schmerzen im Knie belästigt, die zeitweise infolge von Erguss in das Gelenk zunehmen können.

Nachdem sich das nekrotische Knochen- und Knorpelstück von der Epiphyse abgetrennt hat und zu einem freien Körper im Gelenk geworden ist, treten die typischen Gelenkmaussymptome mit plötzlichen Schmerzen und Fixierung des Gelenkes in einer gewissen Stellung auf. In manchen Fällen kann die Gelenkmaus palpiert werden; in anderen verursacht der freie Körper recht geringe Beschwerden.

Die O. d. tritt in der Regel bei jungen Personen, gewöhnlich am Ende der Entwicklungsjahre und einige Zeit danach auf. Doch kommt sie auch bei älteren Leuten vor und ist bei solchen beschrieben worden. So waren 7 von MARTENS 40 Fällen zwischen 30 und 40 Jahre alt. Die Krankheit findet sich häufiger bei Männern als bei Frauen, ist nicht selten doppelseitig und meist in das Kniegelenk lokalisiert. In der überwiegenden Zahl der Fälle ist der mediale Condylus affiziert. In seltenen Fällen liegt der Herd in dem lateralen Condylus, und einigemal sind Fälle beobachtet worden, wo sowohl der mediale als der laterale Condylus Sitz einer O. d. war. Meistens fehlt jede Form von Trauma in der Anamnese oder es wird eine leichte Kontusion od. dgl. als Ursache der Krankheit angegeben.

Bei der Diagnose der O. d. spielt die Röntgenuntersuchung die grösste Rolle. Sogar bei der Inspektion des eröffneten Gelenkes kann man sich irren, da die Knorpelschicht, die die nekrotische Partie bedeckt, völlig normal sein kann und nicht verrät, dass unter derselben eine Knochennekrose vorhanden ist. Dies kommt speziell in den frischen Fällen vor. Nicht selten ist es geschehen, dass man sich gezwungen gesehen hat, das Gelenk wieder zu schliessen, ohne die Stelle der Nekrose gefunden zu haben, während eine spätere Röntgenuntersuchung deutlich das Vorhandensein von O. d. gezeigt hat. Manchmal lässt der Knorpel über der Nekrose eine leichte Missfärbung, die oft ins Gelbe spielt, erkennen oder es zeichnet sich die Demarkationslinie selbst in Form einer flachen Furche ab.

Die Röntgenbilder bei Fällen von O. d. sind sehr charakteristisch. Wie erwähnt, ist der mediale Condylus der gewöhnlichste Platz einer O. d. Hier sieht man nahe bei der Gelenkfläche eine Knochenpartie, die durch einen helleren, einige Millimeter breiten Rand von der Umgebung geschieden ist. Man hat den Eindruck, dass ein Stückchen von dem Condylus losgesprengt worden ist, dass es aber noch in der Grube sitzt. In diesem Stadium der Krankheit haben wir es mit einer örtlichen Knochennekrose zu tun, die durch einen Bindegewebswall von dem gesunden Teil der Epiphyse getrennt ist. Die Knorpeldecke

ist oft unverändert: die nekrotische Knochenpartie prominiert nicht über die Gelenkfläche. Erst später, wenn der Abstossungsprozess fortgeschritten ist, steigt sie aus der Grube hervor, um sich später ganz aus dem Bett zu lösen und ein freibeweglicher Körper im Gelenk zu werden. Kurz bevor dies geschieht, kann man sehen, dass sie durch einen schmalen Strang noch an dem Bett festhängt. Als freien Körper kann man sie überall in dem Gelenk finden, und nur das Gelenkmausbett an der typischen Stelle gibt an, dass es sich um O. d. handelt.

Insbesondere sind die Profilbilder des Gelenkes typisch. In diesem sieht man in dem medialen Condylus oder manchmal in dem lateralen, einen segmentförmigen, grösseren oder kleineren Defekt, dessen gegen das Gelenk gerichtete konvexe Kontur oft bis zur Gelenkfläche reicht. Diese Knochenhöhle kann mehr oder weniger Knochenfragmente enthalten oder sie kann auch leer sein, wobei in dem Gelenk eine oder mehrere Gelenkmäuse entdeckt werden.

Im folgenden werde ich über eine Anzahl Fälle von O. d. berichten. Es sind vor allem die röntgenologischen Befunde, die ich besprechen will, und zwar speziell mit Rücksicht auf die neuen Theorien von AXHAUSEN, die als wohlbegründet und äusserst wertvoll betrachtet werden dürfen. In den Fällen, wo der freie Gelenkkörper auf operativem Weg entfernt worden ist, habe ich auch ein Röntgenbild von ihm aufgenommen in der Absicht, die Struktur des Knochenkernes festzustellen. Einer O. d., wie überhaupt allen Epiphyseonekrosen, liegt nach AXHAUSEN eine primäre aseptische Knochennekrose in der Epiphyse zugrunde. Die nekrotische Knochenpartie erleidet eine verschiedene Umwandlung je nachdem, ob Impressionsfrakturen mit »Trümmerwallbildung» hinzustossen oder nicht. Es kann mithin von Interesse sein, die Strukturverhältnisse in dem abgestossenen Knochenstück im Röntgenbild zu studieren.

*Fall 1.* S. W. 21 Jahre. Fräulein. Seit 1 Jahr »rheumatische» Empfindungen im linken Knie. Keine schweren Schmerzanfälle. Ein Trauma ist nicht vorhanden gewesen. Zeitweise leichte Schwellung am Knie. Beweglichkeit des Knies frei. Eine Operation wurde nicht ausgeführt.

Das *Röntgenbild* des linken *Kniegelenks* (Fig. 1) in ant.-post. Richtung zeigt in dem medialen Femurcondylus nahe der Gelenkfläche ein bohnengrosses Knochenstück, das ihn einer Höhle liegt. Die Knochenkonturen der Höhle sind leicht sklerotisch. Der Knochenkörper scheint aus zwei Fragmenten zu bestehen, einem bikonvexen und einem anderen, schmalen und unregelmässigen, das über der oberen konvexen Kontur liegt.

Im Profilbild (Fig. 2) sieht man, dass der Knochendefekt (die Aufhellung) ovale Form und eine Länge von etwa 2 cm hat. In demselben liegen einige Knochenfragmente, die die Höhle jedoch nur teilweise ausfüllen. Die Gelenkflächen sind sonst normal und die Struktur und der Kalkgehalt der Knochen überall wie gewöhnlich. Das vorliegende Röntgenbild ist typisch für O. d. — Im Sagittalbild ist ein abgerundeter Knochenkörper zu sehen, der im Begriff ist, sich

von der Umgebung abzulösen, Er liegt noch in dem Bett wie ein Ei im Nest. Das Seitenbild zeigt mehrere sequesterähnliche Knochenfragmente, die die Höhle nur teilweise ausfüllen.

Der Prozess befindet sich in diesem Fall in dem Stadium, wo sich, nach AXHAUSEN, ein Wall von Granulationsgewebe um die nekrotische Knochenpartie gebildet hat und eine allmählich vor sich gehende Oberflächenresorption derselben stattfindet. Kann dies ungestört geschehen, so füllt sich der Defekt vollständig aus, kommt aber ein Trauma und trennt die nekrotische Knochenpartie ab, so entsteht in dem Gelenk ein freier Körper, ein Mus articularis.

Die Veränderungen am Knochen liegen an der für O. d. typischen Stelle, im inneren Teil des medialen Condylus. Es kann auch kein Trauma als Ursache der Affektion nachgewiesen werden, weshalb wir das klassische Bild einer Osteochondritis dissecans haben, wie schon KÖNIG sie beschrieben hat.

*Fall 2.* H. S. 27 Jahre. Dienstmagd. In die Chirurgische Klinik aufgenommen am 13. X. 25. Seit dem 19. Jahre Steifigkeit des rechten Knies. Pat. kann sich nicht erinnern, das sie sich einmal das Knie verletzt hätte. Sie hat nie Schmerzen im Knie gehabt ausser in den zwei letzten Wochen, wo sie auch einen beweglichen Körper im oberen Teil des Kniegelenks bemerkt hat.

Rechtes Kniegelenk geschwollen. Patella-Ballottement. Rechts von der Patella ist ein etwas mehr als erbsengrosser Fremdkörper zu fühlen, der verschiebbar ist und bisweilen ganz zum Verschwinden gebracht werden kann. Das Kniegelenk in leichter Flexion.

Das in ventro-dorsaler Richtung von dem *Knie* aufgenommene *Röntgenbild* (Fig. 3) zeigt im äusseren Teil des *lateralen* Femurcondylus eine grosse Aufhellung (Defekt), in der ein mandelgrosses Knochenstück liegt. Der laterale Femurcondylus weist einen arthritischen Vorsprung auf, sonst aber sind die Gelenkflächen normal. Etwas lateral von der Eminentia intercond. ist über der Gelenkfläche der Tibia schwach die Kontur eines freien Körpers zu erkennen. Im Profilbild (Fig. 4) des Knies bemerkt man eine abgerundete Höhle im hinteren Teil des lateralen Femurcondylus. In der Höhle, die in weiter Ausdehnung bis zu der Gelenkkontur reicht, ist ein Knochenstück zu sehen, das dieselbe teilweise ausfüllt. Ein anderes freies Knochenstück erscheint im vorderen Teil des Gelenkes, und ferner bemerkt man über der Patella einen spulförmigen Körper mit glatten, scharfen Konturen.

Bei der Operation wird in dem lateralen Femurcondylus eine Usur von Knorpel und darunterliegendem Knochen konstatiert, die eine fingerspitzengrosse Höhle verursacht hat. Aus dieser wird ein »Knorpelstück von derselben Grösse wie die Höhle hervorluxiert. Aus der Gelenkhöhle wird ein ähnliches, aber etwas kleineres Stück extrahiert.

Das Röntgenbild und der Krankheitsverlauf sind für O. d. charakteristisch. Von dem Gewöhnlichen abweichend ist nur das höhere Alter der Patientin und die Lokalisation der Affektion. Die Veränderungen sind in diesem Fall in den lateralen Femurcondylus verlegt, während in der Regel der mediale der Sitz des dissezierenden Prozesses ist. Einzelne analoge Fälle sind beschrieben, aber sie gehören doch zu den Seltenheiten. Fälle bei höherem Alter sind, wie früher erwähnt, u. a. von MARTENS beschrieben worden.

Zwei Gelenkmäuse wurden nach der Operation zurückbehalten. Die eine von ihnen zeigt im sagittalen *Röntgenbild* (Fig. 5) einen wohlabgerundeten Knochenkern, der von einer breiten Schicht strukturlosen, für die Strahlen partiell durchscheinenden Gewebes umgeben ist. Die Kontur des Knochenkerns ist in der einen Hälfte der Peripherie sehr scharf. Man glaubt zu erkennen, dass eine Knochenlamelle die Kontur begrenzt und umsäumt. Die andere Hälfte der Peripherie ist zerfetzt. Einzelne kleine Fragmente liegen an der Randkontur. Die Struktur des Knochenkerns ist schön und regelmässig netzförmig. Im Profil (Fig. 6) zeigt der Knochenkern Spulform. Man sieht, dass die Knorpeldecke nur die eine Fläche des Knochenstückes bekleidet, während die andere, die eine gleichmässige Kontur besitzt, ohne Knorpelbekleidung ist. Man dürfte annehmen können, dass dieses Knochenstück dasjenige ist, welches sich zuerst nebst dem darüberliegenden Gelenkknorpel abgelöst hat. Mit dem Knorpelteil der Gelenkfläche ist also ein wohlstrukturiertes Knochenstück gefolgt, dessen nach dem Bett hin gerichtete Fläche eine glatt abgeschliffene Kontur aufweist.

In dem Bett liegt noch ein anderes Knochenfragment, das ebenfalls auf dem Röntgenbild zu sehen ist. Es hat einen recht wohlstrukturierten Knochenkern (Fig. 7), ist aber stellenweise stark usuriert. Die Destruktion reicht stellenweise tief nach innen, was aus dem Profilbild (Fig. 8) der Maus hervorgeht. Die Knorpel-Bindegewebsbekleidung ist bei diesem Stück auf einen schmalen Saum in einem kleineren Teil der Peripherie beschränkt.

Wenn wir das Aussehen der zuerst beschriebenen Gelenkmaus näher analysieren, konstatieren wir, dass eine Zerstörung des Knochens in Form von Einbuchtungen nicht zu beobachten ist, wohl aber einige kleine abgesprengte Knochenstücke bei der einen Kontur; dass die Knochenstruktur und die Kontur im übrigen intakt sind. Die nach dem Bett hin gerichtete Fläche ist ebenso ganz gleichmässig und ohne eine in Röntgen sichtbare Knorpel-Bindegewebsbekleidung. Hieraus dürfte man schliessen können, dass dieses Stück durch einen Abgrenzungsprozess von der Art, wie ihn AXHAUSEN beschrieben hat, abgetrennt worden und dass dies geschehen ist, ohne dass noch eine Anfressung durch Markgranulationen vorhergegangen ist. Man wäre geneigt, in der Spulform, die das Stück im Profilbild hat, einen Ausdruck dafür zu sehen, dass der definitiven Ablösung eine Abschleifung desselben vorangegangen ist. Auch der andere Gelenkkörper hat eine abgerundete Form, er sieht aber aus, als wäre er sozusagen wurmstichig. Dieses Aussehen deutet auf eine lakunäre Resorption durch Markgranulationen.

Die ursprüngliche nekrotische Knochenpartie ist also in diesem Fall in drei Stücke geteilt worden, von denen nur zwei bei der Operation entfernt oder aufbewahrt worden sind. Diese zwei zeigen gerundete, gleichmässige Konturen und eine gute Knochenstruktur im grösseren Teil des Kernes. Die Teilung kann man sich auf zweierlei Weise entstanden denken. Entweder ist der tote Knochen bei den physiologischen Bewegungen des Gelenkes frakturiert worden oder die Markproliferationen haben die Zerstückelung ausgeführt. Wegen der abgeschiffenen

Konturen stellt sich die erstere Möglichkeit als die wahrscheinlichere dar. Das äussere der frakturierten Stücke hat sich nebst der Knorpeldecke abgelöst, während das andere Stück in der Höhle liegen geblieben ist. Im Profilbild sieht man jedoch, dass sich dieses Stück nicht auf dem Boden der Höhle, sondern in gleicher Höhe mit der Gelenkfläche befindet. In dem Operationsprotokoll hinwieder ist angegeben, dass die Gelenkmaus ihrer Grösse nach der mit dem Finger palpablen Höhle entspricht. Diese muss also im übrigen mit einem Gewebe gefüllt sein, das die Strahlen nicht absorbiert. Dieses Gewebe kann kaum etwas anderes als Knorpel oder Bindegewebe sein. In der Höhle hat folglich eine lebhafte Proliferation von Knorpel und Bindegewebe stattgefunden, und dieser kräftige Proliferationsprozess hat das Stück sozusagen aus der Höhle herausgeschoben.

*Fall 3.* R. S. Glasschleifer. 22 Jahre. Seit August 1928 Reissen im linken Kniegelenk, doch recht selten auftretend. Um Weihnachten desselben Jahres bekam Pat. plötzlich beim Tanzen eine heftige Schmerzattacke im Knie und konnte dasselbe einige Zeit danach nur schwer ganz ausstrecken. Dies hat sich später ein paarmal wiederholt. Pat. kann jetzt gehen und das Bein ungehindert bewegen, aber das Gelenk knarrt beim Gehen. Pat. hat sich das Knie niemals verletzt.

Ein am 3. I. 29 vom *Knie* aufgenommenes *Röntgenbild* (Fig. 9) zeigt eine recht grosse Aufhellung im medialen Femurcondylus, einen Defekt im Knochen nahe bei der Gelenkfläche. Ein freier Knochenkörper ist nicht in der Höhle zu bemerken. Ebenso wenig ist anderswo im Gelenk eine Gelenkmaus zu finden. Im Seitenbild (Fig. 10) zeichnet sich der Defekt im Knochen als längliche, bikonvexe Aufhellung ab, die jedoch nicht bis zur Gelenkfläche reicht.

In diesem Fall ist kein »Ei im Nest» zu entdecken, die Höhle ist leer. Auch im Gelenk zeigt sich kein freier Körper; ein Knochenstück, das dem recht grossen Defekt im Femurcondylus entspräche, ist nicht anzutreffen. Der regeneratorische Prozess hat also den Knochensequester total resorbiert. Nach den klinischen Symptomen zu schliessen, ist jedoch ein freier Körper in dem Gelenk vorhanden. Da dieser freie Körper im Röntgenbild nicht hervortritt, muss er aus der Knorpeldecke über der Knochennekrose bestehen. Ein subchondraler Knochen ist bei der Abstossung nicht mit dem Gelenkknorpel gefolgt, sondern die ganze nekrotische Knochenpartie ist resorbiert und in durchscheinendes Gewebe, Binde- oder Knorpelgewebe umgewandelt worden. Der von AXHAUSEN beschriebene Regenerationsprozess hat also in diesem Fall einen sehr aggressiven Charakter gehabt. Eine Neubildung von Knochen hat nicht stattgefunden, sondern aller nekrotisierte Knochen ist konsumiert worden. Ein Umbau oder eine Abgrenzung im Sinne AXHAUSEN ist nicht zustande gekommen, die zerstörende Tendenz hat über die aufbauende dominiert.

Ein Trauma ist in diesem Fall nicht vorgekommen. Die vielleicht etwas forcierten Bewegungen des Gelenks während des Tanzes haben genügt, um den freien Körper aus dem Mausbett zu lösen. Auch kann man sich denken, dass er sich schon früher, vor dem Tanzen, spontan losgemacht hat. Bei dem Tanz ist er eingeklemmt worden und hat die Schmerzattacke verursacht. Dass den Gelenkveränderungen ein alter Prozess in der Gelenkfläche zugrunde liegt, sieht man daraus, dass sich die recht grosse Nekrose im Knochen bereits in ein nicht strahlenabsorbierendes Gewebe umgewandelt hat.

*Fall 4.* V. A. 27 Jahre. Arbeiter. Kurze Zeit vorher Schmerzen im *rechten* Knie beim Gehen. Nach Angabe des Pat. wäre ein leichtes Trauma vorhergegangen. Das *linke* Knie ist gesund und nie einem Trauma ausgesetzt gewesen.

Ein von beiden *Knien* in ventro-dorsaler Richtung aufgenommenes *Röntgenbild* (Fig. 11) zeigt den überraschenden Befund, dass *beide Kniegelenke* Sitz einer Osteochondritis dissecans sind. An der typischen Stelle im medialen Femurcondylus findet man ein Gebiet mit fleckiger Aufhellung sowohl im rechten wie in dem vom Pat. als gesund angesehenen linken Kniegelenk. Im rechten Kniegelenk erscheint ausserdem ein langer, schmaler, horizontal verlaufender Schatten bei dem lateralen Tuberculum intercond. Dieser Schatten stellt wahrscheinlich den Knochenkern der Gelenkmaus dar, aber er entspricht an Grösse nicht dem Defekt, der speziell im Profilbild (Fig. 13) in seiner ganzen Ausdehnung zum Vorschein kommt. Im linken Kniegelenk ist keine Gelenkmaus zu bemerken.

Dieser Fall veranschaulicht mit aller Deutlichkeit, dass der O. d. ein allmählich verlaufender Dissektionsprozess und kein Trauma zugrunde liegt. Von dem Krankheitsprozess im linken Knie hat Pat. keine Ahnung gehabt, sondern er wurde zufällig bei der Röntgenaufnahme entdeckt. Auch der dünne, unansehnliche Knochenkern in dem auf dem Röntgenbild des rechten Knies sichtbaren Fremdkörper legt nahe, dass der Prozess alten Datums ist. Wie schon erwähnt, ist dieser Knochenkern bedeutend kleiner als der Defekt im Knochen und hat ausserdem zerfetzte Konturen. Es hat also eine Einschmelzung und Resorption der Knochennekrose stattgefunden, und der augenscheinliche Grössenunterschied zeigt, dass der Prozess schon längere Zeit vor sich gegangen ist. Einen anderen Zusammenhang als den, dass bei dieser Gelegenheit die definitive Ablösung selbst von der Femurepiphyse erfolgt ist, kann dieser Prozess nicht mit dem Trauma haben. Der eigentliche Dissektionsprozess hat gewiss lange vorher stattgefunden. Das Trauma hatte das Gelenk kurz vor der Untersuchung betroffen, weshalb eine so weit vorgeschrittene Destruktion des Knochenstückes, wie sie in diesem Fall beobachtet wurde, nicht während der kurzen Zeit zwischen dem Trauma und der Untersuchung vor sich gegangen sein kann.

*Fall 5.* E. L. 22 Jahre. Schuhmacher. In die Chirurgische Klinik aufgenommen am 21. III. 28. Während 10 Jahren ist das rechte Knie von Zeit zu Zeit beim Gehen empfindlich gewesen. Vor 3 Jahren war das Kniegelenk oft, speziell nach Spaziergängen geschwollen. Das Knie ist wie steif gewesen, und Pat. hat oft gehinkt. Die Symptome haben sich allmählich ohne deutliche Ursache entwickelt. Vor 6 Monaten stürzte Pat. beim Radfahren und stiess sich an das rechte Knie. Eine äussere Verletzung war nicht zu sehen. Einige Monate später entdeckte Pat. einen beweglichen Fremdkörper auf der Innenseite des Gelenks. Das rechte Knie geschwollen. Erguss in das Knie. Das Kniegelenk wird leicht flektiert gehalten. Im medialen oberen Teil des Gelenks ist ein daumenspitzengrosser, beweglicher, platter Körper zu fühlen, der leicht in das Gelenk verschoben werden kann.

*Röntgenuntersuchung.* Im Ventrodorsalbild (Fig. 13) des rechten *Knies* ist eine $1^1/_2 \times 3$ cm grosse Aufhellung (Defekt) zu bemerken, die fast den ganzen medialen Femurcondylus einnimmt. Die Konturen sind unregelmässig und unscharf. Sichere Knochensequester sind nicht in der Höhle zu sehen. Im Profilbild (Fig. 14) dagegen sind in der Höhle unregelmässige Knochenreste zu erkennen. Die Höhle ist sehr gross: Länge ca. 5 cm, Höhe 2 cm. In ihrem hinteren Teil sieht man einen abgerundeten Knochenkörper und vor diesem unregelmässige Knochenstücke. Zwischen den Kondylen liegt die Fabella, das typische Sesambein. Auf der medialen Seite des Femurs, etwas über der Patella, erscheinen einige Schattenflecken, die wahrscheinlich den Knochenkern einer Gelenkmaus darstellen.

In diesem Fall ist ein sehr grosser Knochendefekt vorhanden, der an der für O. d. typischen Stelle, im medialen Femurcondylus nahe der Gelenkfläche liegt. Ein leichtes Trauma findet sich in der Anamnese, aber es fällt schwer sich vorzustellen, dass es die Abspaltung eines so grossen Knochenstückes wie des hier in Frage stehenden verursacht hätte. Die Krankheitsgeschichte ergibt auch, dass schon vor dem Trauma ein langwieriger Prozess im Knie vor sich gegangen ist, so dass dieses Trauma mit grosser Wahrscheinlichkeit nur die Ursache dazu gewesen ist, dass eine vorher vorhandene sequestrierte Knochenpartie zertrümmert und von der Umgebung abgelöst wurde.

Bei der Operation wird ein daumenspitzengrosses »Knorpelstück» extrahiert, das durch einen dünnen Strang mit dem Boden eines grossen, im medialen Femurcondylus gelegenen Defektes zusammenhängt. Die Grube des Femurs wird »narbig umgewandelt» gefunden. Es wurde versäumt, die im Röntgenbild festgestellte freie Gelenkmaus im oberen Teil des Gelenkes herauszunehmen. Die Folge hiervon war, dass sich Pat. einen Monat später mit einer ähnlichen Beschwerde wie vorher einfand. Durch eine zweite Operation wurde aus dem lateralen Teil des stark erweiterten oberen Rezesses ein grosses ($3 \times 3$ $^1/_2$cm) und ein kleineres (erbsengrosses) »Knorpelstück» entfernt.

Das *Röntgenbild* (Fig. 15) der bei der ersten Operation entfernten *Gelenkmaus* zeigt einen abgerundeten Knochenkörper mit einer schön hervortretenden spongiösen Struktur, die in den peripheren Teilen etwas dünner als in den zentralen ist. Die Kontur ist meistenteils scharf und gleichmässig, weist aber stellenweise kleinere Einbuchtungen auf. Im Sagittalbild des Knochenkörpes bemerkt man eine Aufhellung, die die Form eines verzweigten Streifens hat und schmal wie eine Linie ist. Sie kann wohl nur als eine Frakturlinie gedeutet werden. An einer kleinen begrenzten Stelle erblickt man kleine, scharfe, punktförmige Zerstörungen der Knochenstruktur. Das Knochenstück ist von einem durchsichtigeren, strukturlosen Gewebe umgeben, das einen stellenweise breiteren, stellenweise schmäleren Saum bildet. Im Profil gesehen (Fig. 16), zeigt der Knochen-

kern überall scharfe Konturen mit einer Knochenlamelle als äusserer Grenze. Ausserhalb dieser ist eine Hülle von strukturlosem Gewebe zu bemerken.

Das bei der zweiten Operation herausgenommene »Knorpelstück» ist eine grosse, platte Scheibe, $3^1/_2 \times 3$ cm messend. Sein Röntgenbild (Fig. 17) gibt an, dass es aus dem abgestossenen Gelenkknorpel mit anhängenden Knochenresten besteht. Im Sagittalbild sind auch in den peripheren Teilen Knochenreste zu bemerken. Diese erweisen sich stellenwise als wohlstrukturierte und wohlbegrenzte Knocheninseln, stellenweise als strukturlose Knochenreste. In der Mitte findet sich eine kleine wohlbegrenzte Knocheninsel mit guter Knochenstruktur. Das Profilbild (Fig. 18) gibt an, dass diese Knochenreste gegen das Mausbett hin nur von einer dünnen Schicht Knorpelbindegewebe bedeckt sind. Die andere der Gelenkmäuse (Fig. 19), die bei der zweiten Operation herausgenommen wurden, hat die Grösse einer Erbse und besteht nach dem Röntgenbild in einem runden, wohlstrukturierten und wohlbegrenzten Knochenkörper. Auf ihrem Profilbild sieht man, dass ihre eine Fläche mit Knorpelgewebe bedeckt ist, während die andere entblösst ist (Fig. 20).

Die Röntgenbilder der Gelenkmäuse und des Gelenkes selbst dürften folgende Schlüsse zu ziehen erlauben. Unter der Knorpeldecke hat die nekrotische Knochenpartie recht grosse Destruktionen erlitten. Der zunächst unter dem Gelenkknorpel liegende Knochen ist in grosser Ausdehnung resorbiert worden, so dass stellenweise aller Knochen zerstört ist. An anderen Stellen sind einzelne wohlbegrenzte Knocheninseln mit guter Knochenstruktur bestehen geblieben. Sie haben sich nebst dem Knorpelstück von der Gelenkfläche abgelöst. Unter dem Gelenkknorpel in der Destruktionshöhle hat sich ausserdem ein anderer Knochenkörper mit scharfen Konturen und einer deutlichen netzförmigen Knochenstruktur abgegrenzt. Zu unterst, im tieferen Teil der Höhle, findet sich Narbengewebe. Da die zurückbehaltenen Knochenkörper ihrer gesamten Menge nach nicht annähernd dem grossen Defekt entsprechen, scheint es, als sei der grössere Teil der nekrotischen Knochenpartie in nicht strahlenabsorbierendes Gewebe (Bindegewebsknorpel) umgewandelt worden. Man hat den Eindruck, dass der zu der Knochennekrose führende Prozess eine kräftige Knochenzerstörung oder einen in grossem Umfang resorbierenden Prozess hervorgerufen hat, und dass unter der Knorpeldecke ein grosser Teil des Knochens ganz aufgelöst worden ist, während gewisse Partien, wahrscheinlich infolge einer »Trümmerwallbildung», dem Angriff widerstanden haben. Aus diesen haben sich abgerundete Knochenkörper mit scharfen Konturen und normaler Knochenstruktur gebildet. Auf diese Weise scheint die Entstehung multipler Gelenkmäuse erklärt werden zu können. Ein solcher Destruktionsprozess und die Abgrenzung der Knochenkörper im Mausbett erfordern eine lange Zeit. Im Hinblick hierauf ist es unmöglich, dass die direkte Ursache zu dem Prozess in der Femurepiphyse des betreffenden Patienten das Trauma wäre, dem er vor ganz kurzer Zeit ausgesetzt gewesen ist. Dagegen ist es wahrscheinlich, dass die Knorpeldecke

nebst den mitfolgenden Knochenresten bei dieser Gelegenheit abgelöst worden ist. Auch in diesem Fall ist keine Spur von einer Tendenz zu Knochenneubildung in dem osteochondritischen Prozess zu erkennen.

*Fall 6.* L. L. 25 Jahre. Arbeiter. In die Chirurgische Klinik aufgenommen am 4. XI. 25. Solange sich Pat. erinnern kann, hat er leichte Beschwerden in seinem linken Knie gehabt. Er hat sich nie daran gestossen. Beim Gehen und Laufen ist das Knie empfindlich gewesen, so dass Pat. dann und wann hinken musste. In letzer Zeit hat sich der Zustand verschlechtert. Im Gelenk ist oft bei Bewegungen ein knarrendes Geräusch zu hören, und mitunter ist das Gelenk »eingeschnappt»! Im Sommer 1925 bemerkte Pat. bei einer solchen Gelegenheit, dass ein empfindlicher Knoten auf der Innenseite des Gelenkes auftrat. Bei Druck verschwand derselbe mit einem knackenden Geräusch, und das Gelenk konnte wieder frei bewegt werden.

Im *Röntgenbild* (Fig. 21) des *Knies* ist bei der Gelenkfläche in dem medialen Femurcondylus ein grosser Knochendefekt zu sehen. Der Defekt hat auf dem Seitenbild (Fig. 22) eine Längserstreckung von 3 cm. Im vorderen Teil des Gelenks ist ein schmaler Knochenstreifen von $2^1/_2$ cm Länge zu bemerken; dieser bildet den Kern des von dem Femurcondylus sequestrierten Knochenknorpelstückes. Wie es scheint, entspricht die Grösse des freien Knochenstückes nicht annähernd dem Defekt in dem Knochen.

Bei der Operation wird ein Knorpelstück von der Grösse eines Zehnpennistückes, von unregelmässiger Form und mit recht gleichmässigen Konturen entfernt. Das *Röntgenbild* (Fig. 23) dieser *Gelenkmaus* zeigt, dass in ihr diffus zerstreute Kalkflecken ohne regelmässige Struktur auftreten. Das Profilbild (Fig. 24) lässt erkennen, dass die Lage des Knorpels und des Knochens im Verhältnis zueinander nicht von der Art ist wie in dem abgestossenen Gelenkknorpel mit dem darunterliegenden Knochen, sondern dass die Knochenreste auf den ganzen Querschnitt verteilt sind. Da ein anderes Knochenstück mit daranhängendem Gelenkknorpel weder in dem Gelenk noch in dem Mausbett zu entdecken ist, scheint es, als sei die betreffende Gelenkmaus mit dem abgestossenen Gelenkknorpel identisch, in dem später sekundäre Verkalkungen entstanden sind. Für die Richtigkeit dieser Annahme sprechen auch die struktur- und formlosen Kalkmassen in der Gelenkmaus. Die ganze Knochenpartie, die ursprünglich der Nekrose anheimgefallen ist, würde also resorbiert und durch Knorpel- oder Bindegewebe ersetzt worden sein. Dies wiederum würde darauf deuten, dass der reaktive Prozess bei der Epiphysennekrose von ausserordentlich aggressiver Natur gewesen ist.

*Fall 7.* V. A. 37 Jahre. Arbeiter. In die Chirurgische Klinik aufgenommen am 7. IX. 27. Vier Wochen vor der Aufnahme bekam Pat. beim Grabenziehen plötzlich Schmerzen im rechten Knie, das sich in leicht flektierter Stellung fixierte. Nach einiger Massage konnte er das Knie wieder ausstrecken und bewegen. Später sind ähnliche Anfälle dann und wann ohne bekannte Ursache aufgetreten. Von einem Trama ist das Knie niemals betroffen worden.

Pat. hält das Knie leicht flektiert. Es kann weder aktiv noch passiv völlig ausgestreckt werden. Es ist leicht geschwollen. Ein Fremdkörper ist nicht zu palpieren.

Ein sagittales *Röntgenbild* (Fig. 25) des *Knies* zeigt einen langgestreckten Defekt im medialen Femurcondylus bei der Gelenkfläche. In der Nähe desselben glaubt man in der Gelenkspalte kleine Knochenfragmente zu erkennen. Im Seitenbild (Fig. 26) findet man, dass die Knochenhöhle namentlich in der Richtung von vorn nach hinten recht gross und zwar ca. 3 cm lang und $1^1/_2$ cm hoch ist. Die

Eminentia und der laterale Tibiacondylus zeigen leichte arthritische Veränderungen, und die Gelenkspalte ist etwas asymmetrisch, d. h. medial schmäler.

Bei der Operation wird im medialen Condylus ein daumennagelgrosser Defekt konstatiert, und im Gelenk wird ein diesem Defekt entsprechender freier Körper entdeckt, welcher entfernt wird.

Ein *Röntgenbild* (Fig. 27) der *Gelenkmaus* zeigt, dass wir es mit einem grossen Knorpelstück zu tun haben, in dem strukturlose kleine Knochenmassen zerstreut liegen. Das Profilbild (Fig. 28) wiederum gibt zu erkennen, dass es sich hier um den abgestossenen Gelenkknorpel mit daranhängenden Resten des subchondralen Knochens handelt. Der letztere wird gegen das Mausbett hin nicht von einer Knorpel- oder Bindegewebsschicht bedeckt.

Von der ursprünglichen, recht grossen Knochennekrose sind also nur diese kleinen, an dem Knorpel festhängenden Knochenreste übrig, während der Hauptteil destruiert und durch nicht verkalktes Gewebe ersetzt worden ist. Auch in diesem Fall vermissen wir den knochenneubildenden Anpart an dem Prozess: dieser wird ganz von der Knochendestruktion beherrscht.

Ein Trauma tritt in der Anamnese nicht hervor. Auch wenn man annehmen möchte, dass ein solches beim Grabenziehen vier Wochen vorher stattgefunden habe, ist es doch deutlich, dass es nicht die Ursache zu dem Prozess in dem Femurcondylus gewesen sein kann, weil die grossen Veränderungen, die im Röntgen zum Vorschein kommen, deutlich erkennen lassen, dass ein langwieriger Prozess vorhergegangen ist. Doch ist es möglich, dass die gesteigerten anstrengenden Bewegungen im Kniegelenk genügt haben, eine Abschälung der unterminierten Knorpeldecke in der Femurepiphyse zustande zu bringen.

*Fall 8.* A. E. 22 Jahre. Zollwächter. In die Chirurgische Klinik aufgenommen am 16. IX. 27. Im Alter von 12 Jahren hatte Pat. »Wasser» im linken Knie. Nach seinem Militärdienst stellte sich im Dezember 1926 wieder eine Schwellung des Knies ein. Seitdem hat er oft nach grösseren Anstrengungen Schmerzen im Knie gehabt, das sich manchmal in der einen oder anderen Stellung fixierte. Er hat auch einen Fremdkörper im Gelenk, gewöhnlich auf dessen lateraler Seite, aber von Zeit zu Zeit auch medial bemerkt. Der palpable Körper hat sich leicht in das Gelenk hinein verschieben lassen. Ein Trauma gibt Pat. nicht als Ursache der Gelenkbeschwerden an. — Das linke Kniegelenk nicht geschwollen, Beweglichkeit uneingeschränkt. Nach gewissen Manipulationen kann Pat. einen Fremdkörper demonstrieren, der auf der lateralen Seite des Gelenkes hervortritt.

*Röntgenuntersuchung.* Im Sagittalbild (Fig. 29) des *Knies* ist kein völlig sicherer Defekt in den Femurkondylen zu sehen. In der Gelenkspalte zeichnen sich dagegen in der Gegend des lateralen Tuberculum intercond. kleine Kalkschatten ab, die wahrschenlich Teile eines Mus articularis darstellen. Im Profilbild (Fig. 30) sieht man im medialen Condylus einen recht grossen Defekt, der nach Form und Lage an diejenigen erinnert, die wir bei Osteochondritis dissecans gefunden haben. Ausserdem ist ein schmaler, langgestreckter Schatten zu bemerken, der dem Fremdkörper entspricht.

Über die Operation ist angemerkt, dass in den Femurkondylen kein Defekt

entdeckt werden konnte. Einen fingerspitzengrossen, mandelförmigen freien Körper sieht man in der Gelenkhöhle liegen, und derselbe wird entfernt.

Eine *Röntgenuntersuchung* des herausgenommenen *Gelenkkörpers* zeigt im Sagittalbild (Fig. 31) einen abgerundeten fingerspitzengrossen Knorpelkörper, in dem unregelmässige Kalkschatten zerstreut sind. Ein Profilbild des Stückes (Fig. 32) zeigt nach der einen Seite eine wohlabgerundete konvexe Kontur. Diese Kontur ist völlig gleichmässig, und ihre Wölbung entspricht der Wölbung des Knorpels der Gelenkfläche. Auch nach dem Bette hin ist eine recht breite Schicht Knorpelgewebe zu sehen, die jedoch eine leicht wellenförmige Kontur hat. Man dürfte annehmen können, dass diese Maus aus dem Gelenkknorpel besteht, der nebst einigen destruierten Knochenresten abgestossen worden ist. Ein Abgrenzungsprozess hat sie mit einer Knorpel-Bindegewebsschicht von der Epiphyse losgetrennt. Der übrige Teil der Epiphysennekrose scheint durch durchscheinendes, kalkfreies Gewebe ersetzt zu sein.

Ungefähr einen Monat nach der Entlassung findet sich Pat. jedoch wieder mit ähnlichen Beschwerden wie vorher und mit einem palpablen Fremdkörper im Gelenk ein.

In den *Röntgenbildern* des *Knies*, die jetzt aufgenommen werden, ist zu bemerken, dass ein deutlicher Defekt im medialen Femurcondylus auch im Sagittalbild (Fig. 33) hervortritt. In dem Defekt zeichnen sich einige Knochenstücke ab. Im Profilbild (Fig. 34) ist der Defekt ebenso scharf konturiert wie bei der früheren Untersuchung, und er erscheint nach vorn erweitert. In dem Defekt sieht man auch im Profilbild die eben erwähnten Knochenfragmente.

Bei der zweiten Operation wird im medialen Femurcondylus eine fingerspitzengrosse, 1 cm tiefe Grube konstatiert, deren Boden etwas uneben und blutimbibiert ist. In der Gelenkhöhle wird ein freier, mandelförmiger Gelenkkörper gefunden, der in bezug auf seine Grösse der erwähnten Vertiefung im Condylus entspricht.

Das *Röntgenbild* des *extrahierten Körpers* zeigt in sagittaler (Fig. 35) Richtung einen abgerundeten Knochenkern mit gleichmässigen Konturen. In der einen Hälfte desselben sind einige sich kreuzende Frakturlinien zu erkennen. Die Knochenstruktur ist deutlich, normal, doch sieht man stellenweise kleine, scharfe, runde Defekte. Der Knochenkern ist an seiner ganzen Peripherie mit einer ungefähr gleichbreiten Zone von Knorpel-Bindegewebe umgeben. Das Profilbild (Fig. 36) zeigt, dass diese nur die eine Seite des Knochenstücks bekleidet, während die andere entblösst ist. Die Wölbung und die scharfe Kontur der Knorpelschicht deuten darauf, dass wir es mit einem Teil des Gelenkknorpels zu tun haben. Doch ist zu bemerken, dass sich die Knorpelbekleidung über die Ränder des Knochenstücks umbiegt und um dasselbe greift. Dieses Verhalten scheint mir deutlich zu zeigen, dass dieses wohlgeformte Knochenstück kein Frakturfragment, sondern das Produkt eines Abgrenzungs- oder Dissektionsprozesses ist. Es ist von dem Gelenkknorpel ein proliferierendes Gewebe eingedrungen und hat bewirkt, dass sich das Knochenstück abgestossen hat. Die Frakturierung, die das Stück aufweist, ist offenbar sekundär in dem nekrotischen, spröden Knochen entstanden. Die wohlabgerundete scharfe Kontur, die auch an der gegen das Mausbett gerichteten Fläche zu beobachten ist, spricht gleichfalls gegen eine Fraktur als primäre Ursache.

Ein Teil des Mausbettes wurde bei der Operation ausgemeisselt und zurückbehalten. Infolgedessen wurde auch von dieser Partie ein Röntgenbild (Fig. 37) erhalten, welches zeigt, dass sie mit einer recht breiten Schicht strahlendurchlässigen, kalkfreien Gewebes bekleidet ist. Die Loslösung des Stückes ist gerade auf der Grenze zwischen dem Knochen und dem Bett im Nest erfolgt. Dass dieses

blutreiche Granulationsgewebe bei der Ablösung der Maus leicht blutet, liegt nahe und braucht nicht als Zeichen einer Fraktur aufgefasst zu werden, wie manche Autoren gemeint haben.

Die weitere Entwicklung der krankhaften Störung nach der ersten Operation dürfte in diesem Fall folgende gewesen sein. Der mediale Teil der Knochengelenkfläche des Femurcondylus war schon unterminiert, bevor die erste Operation vorgenommen wurde, obwohl deutliche Veränderungen im Knorpel der Gelenkfläche bei der Operation nicht zu Gesicht kamen. Das Bett des abgestossenen Gelenkkörpers war indessen schon da gefüllt, und dies erklärt, weshalb in dem Femurcondylus kein Defekt entdeckt wurde. Während der Zeit zwischen den Operationen, wo der Pat. sein Gelenk unter dem Eindruck, dass dasselbe gesund sei, mehr als gewöhnlich bewegt hat, hat sich das unterminierte Knochenstück nebst dem darüberliegenden Knorpel abgelöst, und gleichzeitig ist das spröde nekrotische Knochenstück frakturiert worden.

*Fall 9.* J. N. 46 Jahre. Chauffeur. In die Chirurgische Klinik aufgenommen am 1. IV. 24. Vor 15 Jahren wurden zwei Gelenkmäuse aus dem rechten Knie extrahiert, welches seitdem gesund war. Vor einem halben Jahr, als Pat. aus einem Motorboot ans Land stieg, bekam er plötzlich heftige Schmerzen im linken Kniegelenk, welches für 24 Stunden in Extensionsstellung »einschnappte». Das Knie war dann einige Tage lang empfindlich, aber Pat. konnte doch gehen. Seitdem hat er mehrmals ähnliche Anfälle im Kniegelenk gehabt. Wie er sagt, hat er sich nie an das Knie gestossen.

Ein *Röntgenbild* des *Knies* (nur das Profilbild ist aufbewahrt) (Fig. 38) zeigt in dem medialen Femurcondylus eine Knochenhöhle, die in bezug auf Lage und Form der bei O. d. gleicht. Im vorderen Teil des Gelenks ist ein Fremdkörper zu erkennen.

Bei der Operation wird aus dem Gelenk ein daumenspitzengrosser, knorpelartiger freier Körper entfernt. Weitere Einzelheiten über den Operationsbefund sind in der Krankheitsgeschichte nicht angegeben.

Ein sagittales *Röntgenbild* (Fig. 39) der *Gelenkmaus* zeigt eine recht grosse Knorpelscheibe, in deren einer Hälfte ein abgerundeter, wohlbegrenzter Knochenkörper liegt. Die Struktur des Knochenstückes ist stellenweise normal netzförmig (spongiös), stellenweise leicht sklerosiert. An einer Stelle der Randkontur ist ein kleines Stück abgesprengt; in der anderen Hälfte der Knorpelscheibe liegen kleine Kalkinseln ohne Struktur zerstreut. Im Profilbild (Fig. 40) sieht man, dass der Knorpel nur die eine Seite des Knochenstückes bekleidet, während die andere — die gegen das Mausbett gerichtete Fläche — entblösst ist. Die abgelöste Gelenkmaus besteht aus dem Gelenkknorpel nebst einem Teil des darunterliegenden Knochens. Ein Teil des subchondralen Knochens ist resorbiert worden, so dass nur kleine Reste an dem Knorpel hängen, während sich aus einem anderen Teil ein abgerundetes, mit scharfen Konturen versehenes Knochenstück geformt hat. Diese Prozesse erfordern beide eine lange Zeit und haben daher nichts mit dem kurz vorher erfolgten Trauma zu tun.

Von der recht grossen Knochennekrose ist also nur das kleine, wohlumgeformte und -abgeschliffene Knochenstück übrig, das sich samt dem Gelenkknorpel abgelöst hat. Auch hier biegt sich der Knorpel um den Rand des Knochen-

stückes, was beweist, dass ein Abgrenzungsprozess und keine Fraktur vorhergegangen ist.

*Fall 10.* E. J. 21 Jahr. Arbeiter. In die Chirurgische Klinik aufgenommen am 20. IX. 25. Ungefähr einen Monat vor der Aufnahme oder näher bestimmt am 27. August 1925 stieg Pat. auf einen losen Stein und glitt mit dem rechten Fuss aus, doch ohne dass das Knie gegen den Boden stiess. Pat. spürte während der ersten Stunden nichts Besonderes im Knie, aber drei Stunden später, als er, nachdem er während der ganzen Zeit mit gebogenem Knie dagesessen hatte, aufzustehen versuchte, fühlte er heftige Schmerzen im rechten Knie, das nicht ausgestreckt werden konnte. Hiernach leichte Schwellung, zeitweise Empfindlichkeit und »Einschnappen» des Knies. In letzter Zeit hat Pat. einen Fremdkörper im Gelenk auf der lateralen Seite gefühlt. Das Knie ist früher gesund gewesen und nie von einem Trauma betroffen worden.

*Röntgenuntersuchung.* Im Sagittalbild (Fig. 41) des *Knies* sieht man in dem medialen Condylus nahe der Mitte des Gelenks einen undeutlich hervortretenden Knochendefekt und über dem lateralen Condylus bis zum Femur ein Knochenstück, dessen Spitze frakturiert ist. Im Seitenbild (Fig. 42) zeichnet sich die Höhle im Femurcondylus undeutlich ab. Sie scheint recht gross zu sein und einzelne kleine Sequester zu enthalten.

Bei der Operation wird aus dem Gelenk eine $1^1/_2 \times 2$ cm grosse Gelenkmaus extrahiert, deren eine Fläche aus Knochen besteht. Angaben über die Beschaffenheit der Gelenkfläche fehlen.

Das sagittale *Röntgenbild* (Fig. 43) des *freien Körpers* zeigt ein längliches, gerundetes Knochenstück mit zierlicher, normaler spongiöser Struktur. Das eine Ende ist frakturiert. Das Knochenstück ist überall von einem fast gleichbreiten Knorpelschatten umgeben. Das Profilbild (Fig. 44) lässt erkennen, dass der Knorpel nur die eine Fläche des Knochenstückes bekleidet und um dessen beide Enden greift. Die Form des Knorpels zeigt, dass er von der Gelenkfläche stammt. Nach hinten gegen das Mausbett sieht man keine Knorpelbekleidung: der Knochen ist entblösst und weist eine gleichmässige, abgeschliffene Kontur auf.

In sämtlichen hier beschriebenen Fällen von Gelenkmaus im Kniegelenk ist kein Trauma vorhanden, das die Ursache zu ihrer Entstehung gewesen wäre. In einzelnen Fällen ist angegeben, dass leichte Distorsionen oder Überanstrengungen der Akutisierung der Symptome vorangegangen sind, aber gewöhnlich sind die Symptome schon längere Zeit vor der akuten Erkrankung verspürt worden. Fühlt man sich unsicher, in welchem Zusammenhang diese leichten Traumen und die Entstehung des freien Körpers zueinander stehen, so hat das Röntgenbild der extrahierten Gelenkmaus die Sache entschieden. Dasselbe hat Veränderungen hervortreten lassen, deren Entstehung lange Zeit in Anspruch genommen hat, während das Trauma kurz vor der Manifestation der typischen Maussymptome stattgefunden hat. Man gewinnt nämlich in mehreren Fällen den Eindruck, dass diese kleinen, innerhalb des Physiologischen fallenden Insulte die Ursache dazu gewesen sind, dass sich die Gelenkmaus von dem Bett losriss, dass aber die Gelenkfläche schon längere Zeit an der kranken Stelle unterminiert war.

Die Röntgenbilder der Kniegelenke haben in allen hier angeführten Fällen völlig identische, für Osteochondritis dissecans typische Veränderungen gezeigt. Der mediale Femurcondylus ist Sitz einer grösseren oder geringeren Knochenzerstörung gewesen, eine Knochenhöhle, die speziell in den Profilbildern in ihrer charakteristischen Form hervortritt. Auf den Bildern sieht man eine segmentförmige, meist recht grosse Aufhellung im Knochen. Die Knochenhöhle hat die Form eines Infarktes, der in der Regel bis zur Gelenkfläche des Femurcondylus reicht. Mitunter können die Veränderungen im Sagittalbild übersehen werden, aber im Profilbild treten sie mit ungewöhnlicher Schärfe hervor. In der Knochenhöhle sind zuweilen ein oder mehrere Knochensequester zu bemerken, aber zeitweilig ist die Höhle leer, was jedoch nicht ausschliesst, dass sie mit nicht strahlenabsorbierendem Gewebe, mit Bindegewebsknorpel oder Granulationsgewebe gefüllt sein kann.

Ich habe die Röntgenbilder einer grösseren Anzahl von Fällen sog. *traumatischer Gelenkmäuse*, d. h. von Fällen mit einem schweren Trauma in der Anamnese durchgemustert und habe in keinem einzigen von ihnen im Femurcondylus einen Knochendefekt, der an den bei O. d. erinnerte, entdecken können. Überhaupt habe ich in den Gelenkflächen keinen Defekt finden können, der dem Knochenkern in der Gelenkmaus entsprochen hätte. Es sieht mithin aus, als ob sich die Spuren in den Gelenkflächen der Knochen nach einer zur Gelenkmaus führenden traumatischen Absprengung recht schnell verwischten, während der Osteochondritis dissecans-Prozess zu einer Höhle führt, die nach den angestellten Beobachtungen mehrere Jahre persistieren kann.

Die röntgenologische Untersuchung der extrahierten Gelenkmäuse hat ergeben, dass sich unter den aus einem Gelenk herausgenommenen freien Körpern *einer* immer als aus dem abgestossenen Gelenkknorpel bestehend erwiesen hat, an dem grössere oder kleinere Partien des subchondralen Knochens hingen. Diese den Knorpel begleitenden Knochenfragmente konnten stellenweise stark destruiert sein und stellenweise eine normale, unberührte, spongiöse Struktur aufweisen. In den Profilbildern der Gelenkmäuse ist beobachtet worden, dass sich der Knorpel über die Ränder des Knochenkerns umbiegt. Der Knochenkern oder die Knochenreste werden gewissermassen von dem Knorpel umschlossen, liegen sozusagen in dem Knorpel eingefasst. Die Knorpelränder sind abgerundet, was zeigt, dass der Knorpel *nicht* auf der Grenze gegen die gesunde Umgebung *abgerissen worden ist*, sondern dass eine Demarkation einwärts nach dem subchondralen Knochen hin stattgefunden hat. Der Abgrenzungsprozess, der sowohl von der Oberfläche als von der Tiefe her vor sich gegangen ist, hat zu einer Ablösung der nekrotischen Partie von dem Condylus mitgewirkt.

Kappis hat auch eine solche Umformung des Gelenkknorpels be-

schrieben, aber seiner traumatischen Gelenkmausgenese treu erklärt er diese Umformung als sekundär, und zwar wäre sie entstanden, nachdem sich das Knorpelstück als freier Körper in dem Gelenk befunden hätte. Sichere Beweise dafür, dass diese Gelenkmäuse auf traumatischem Wege entstanden sind, werden nicht erbracht, weshalb man ebenso gut annehmen kann, dass sie aus einem Osteochondritis dissecans-Herd abgestossene Gelenkknorpel darstellen. Unter diesen Umständen ist es höchst wahrscheinlich, dass die beschriebene Umformung des Knorpels schon *vor* der Ablösung fertig vorgelegen und nur ein Glied in dem charakteristischen Prozess gebildet hat. Die bei den Operationen oft beobachtete Demarkationslinie oder Furche in dem Gelenkknorpel spricht für eine solche von der Oberfläche ausgehende Abgrenzung.

In keinem der »traumatischen» Fälle habe ich eine Gelenkmaus gefunden, die aus Gelenkknorpel mit darunterliegendem Knochen oder aus Gelenkknorpel allein aufgebaut war. Eine Gelenkknorpelfläche ist unter den Gelenkmäusen der eben erwähnten Art nicht angetroffen worden.

Ausser diesen Gelenkmäusen, die aus der Knorpelbedeckung über der nekrotischen Stelle des Knochens bestanden, sind in vielen Fällen ausserdem andere Gelenkmäuse entdeckt worden, die aus einem abgerundeten Knochenkern mit normaler, deutlich hervortretender spongiöser Struktur bestanden und von einer dünneren Schicht strukturlosen, partiell durchscheinenden Gewebes umgeben waren. Diese Gelenkmäuse können sich neben der Gelenkknorpelmaus frei in dem Gelenk finden oder auch noch in dem Mausbett, leicht an demselben adhärierend, angetroffen werden. In einzelnen Fällen sieht man, dass der Gelenkknorpel nebst dem darunterliegenden Knochen die einzige Gelenkmaus ist, die sich infolge des Prozesses gebildet hat. Der Rest der Knochennekrose hat sich in Knorpel-Bindegewebe umgewandelt. Eine eigentliche knochenaufbauende Tendenz bei O. d. — wie sie nach der Annahme AXHAUSENS vorhanden ist — hat in diesen Fällen nicht beobachtet werden können. Am ehesten dominiert die knochenzerstörende Tendenz.

Eine Zusammenstellung der Röntgenbefunde bei der Untersuchung von Gelenken und extrahierten Gelenkmäusen scheint mir die Annahme zu gestatten, dass der Prozess bei Osteochondritis dissecans folgenden Verlauf hat. Eine gewisse Partie der Knochengelenkfläche des Femurs geht in Nekrose über. — Dafür, dass eine Embolie daran Schuld ist, dass ein Knocheninfarkt vorliegt, scheint die ständig wiederkehrende Infarktform in den Profilröntgenbildern des Defekts im Femurcondylus zu sprechen. — Unter der intakten Knorpelfläche erfolgt danach eine intensive Resorption des nekrotischen Knochens. *Zum grössten Teil* wird derselbe durch kalkfreies, für die Röntgenstrahlen durch-

scheinendes Gewebe ersetzt. In der Höhle leisten gewisse Partien dem Resorptions- oder Reparationsprozess grösseren Widerstand, vielleicht gerade darum, weil die spongiösen Räume durch Knochendetritus verstopft worden sind, was nur eine allmählich vor sich gehende Oberflächenresorption ermöglicht. Diese Knochenpartien formen sich zu abgerundeten, scharf konturierten Knochenkörpern um, die dann, wenn der Knorpel abgestossen ist, wie Eier aus dem Nest aus ihrer Höhle herausfallen und in der Gelenkhöhle multiple Gelenkmäuse bilden können. Unter dem Gelenkknorpel kann sich also eine Höhle mit mehreren solchen Knochenkörpern befinden oder die ganze Knochennekrose kann resorbiert und durch Granulationsgewebe ersetzt worden sein. Ein geeignetes leichtes Trauma kann dann dahin führen, dass der Gelenkknorpel nebst einigen Knochenresten abgerissen wird und die einzige Gelenkmaus bildet, die ein solcher Prozess überhaupt entstehen lassen kann. Ausserdem sieht man, dass das subchondrale Knochenstück durch einen von der unteren Fläche des Gelenkknorpels in die Tiefe gehenden Prozess für die Abstossung vorbereitet wird. Der Gelenkknorpel weist abgerundete, über den Knochenkern hängende Konturen auf, welche zeigen, dass sich auf der Grenze zu dem gesunden Knorpel eine Furche oder ein »Wallgraben» gebildet hat.

Das Röntgenstudium der Gelenkmäuse in *traumatischen* Fällen hat ergeben, dass der Knochenkern eine Struktur aufgewiesen hat, die von der bei O. d.-Mäusen abweicht. Oft lassen sie einen stärker verkalkten Kern mit einer völlig unregelmässigen, geschichteten oder flechtwerkartigen Struktur erkennen (Fig. 45). Eine Andeutung von spongiöser Struktur ist nicht zu sehen. Diese Kerne können wahrscheinlich so aufgefasst werden, dass sie durch sekundäre Kalkablagerung in Synovialzotten oder in Knorpel entstanden sind. In den Fällen hinwieder, wo eine spongiosaähnliche Struktur wahrzunehmen ist, ist diese bedeutend weniger dicht als gewöhnlich, und das Knochenstück selbst verrät durch seine Kantigkeit und seine unregelmässige Kontur, dass seine Entstehung mit arthritischen Prozessen in Zusammenhang steht (Fig. 45). In der Tat beobachtet man die fraglichen Mäuse gerade in Gelenken, die schwere arthritische Veränderungen aufweisen. In diesen Fällen habe ich keine solchen wohlabgerundeten Knochenkörper gesehen, wie sie bei O. d. angetroffen werden. Früher wurde erwähnt, dass unter den Gelenkmäusen dieser Kategorie kein abgestossener Gelenkknorpel von derselben ungestörten Form wie bei O. d. entdeckt worden ist.

Hier wäre ich geneigt, die Vermutung auszusprechen, dass die meisten der traumatischen Gelenkmäuse Absprengungen von einem Plus an Gelenkfläche, d. h. Absprengungen arthritischer Vorsprünge und Auflagerungen sind. Hierzu kommt selbstverständlich eine mögliche Ablösung von Gelenkmäusen, die sich in der Kapsel oder anderswo um einen

Kern von Weichteilen gebildet haben. Mögen nicht in den meisten Fällen, wo eine Gelenkmaus als traumatisch angesehen worden ist, spezielle Voraussetzungen für seine Entstehung in dem Gelenk vorhanden gewesen, d. h. mag das Gelenk nicht pathologisch verändert gewesen sein? Wahrscheinlich ist, was schon KÖNIG hervorhob, dass ein Trauma schwerlich von normalen Gelenkflächen im Kniegelenk so kleine Knochenstückchen abspalten kann, dass Gelenkmäuse entstehen; eine kräftige Gewalt hat wirkliche intraartikuläre Frakturen zur Folge. Auch experimentelle Versuche sprechen hierfür, indem es sich als schwierig erwiesen hat, auf experimentellem Wege eine Abspaltung von Stücken zustande zu bringen, die die Entstehung von Gelenkmäusen hervorrufen könnten.

Wenn es richtig ist, dass die traumatischen Gelenkmäuse oft abgesprengte arthritische Knochenneubildungen oder in der Kapsel gebildete Gelenkmäuse sind, ist damit die Erklärung dafür gegeben, dass in diesen Fällen keine ein wohlgeformtes Stück des Gelenkknorpels enthaltende Gelenkmaus angetroffen worden ist. Setzt man hinwieder voraus, dass Abspaltungen normaler Knochengelenkflächen vorkommen, so scheint es, als ob der dabei entstandene Defekt im Knochen sehr schnell geheilt sei, da kein Defekt von der Art wie bei O. d. gefunden wurde.

Meine vergleichenden röntgenologischen Studien über Gelenkmäuse und mit ihnen einhergehende Veränderungen in den Gelenkflächen haben gezeigt, dass die Fälle von Osteochondritis dissecans eine eigene wohlabgegrenzte Gruppe bilden sowohl hinsichtlich der röntgenologischen Struktur der Gelenkmäuse als in bezug auf die röntgenologischen Veränderungen in den Gelenkflächen der Knochen. Wenn wir ferner bedenken, dass in diesen Fällen eine grosse und tiefe Knochenzerstörung bei der Gelenkfläche des Femurcondylus vorliegt und dass sie in der Regel in sämtlichen Fällen dieselbe infarktähnliche Form hat, so wird der Gedanke zunächst auf eine ernstliche Nutritionsstörung in dem Gebiete gelenkt. Die Zirkulationsstörung erreicht wohl ihr Maximum bei einer durch einen Embolus entstandenen Gefässsperre, während man sich denken kann, dass ein nur partielles Hindernis mit Leichtigkeit bei einer unvollständigen Fraktur oder Infraktion entsteht. Die stark ausgeprägte destruktive Tendenz des Osteochondritis dissecans-Prozesses scheint eher für einen embolischen als für einen traumatischen Ursprung zu sprechen.

AXHAUSENS Annahme eines Embolus als Ursache der aseptischen Knochennekrose scheint viel für sich zu haben.

Ob die Osteochondritis dissecans in bezug auf die Art des Prozesses mit den anderen Epiphyseonekrosen gleichgestellt werden darf, ist wohl schwer mit Bestimmtheit auszumachen. Doch hat AXHAUSEN so gewichtige Argumente hierfür vorgelegt, dass es sich höchst wahrscheinlich so ver-

halten dürfte. Der Umstand, dass PERTHES', KÖHLERS und KIENBÖCKS Krankheit nur in den Entwicklungsjahren vorkommt, während die O. d. auch bei älteren Individuen angetroffen wird, braucht nicht gegen einen Zusammenhang zwischen diesen Krankheitszuständen zu sprechen. Die Vaskularisationsverhältnisse in den Epiphysen sind während der Entwicklungsjahre, wie angenommen wird, derart, dass sie leicht zu ausgebreiteten Knochennekrosen durch Embolie führen, während die Blutzufuhr in reiferem Alter so geordnet ist, dass dergleichen nicht wohl stattfinden kann. Man kann gut annehmen, dass die frühere Gefässanordnung in manchen Fällen auch bei weiter fortgeschrittenem Alter in Form einer Anomalie bestehen geblieben ist, welche eine Disposition für embolische Knochennekrosen mit sich gebracht hat.

Herrn Prof. A. KROGIUS und R. FALTIN, die mir die Krankengeschichten freundlicherweise zur Verfügung gestellt haben, spreche ich meinen besten Dank aus.

## ZUSAMMENFASSUNG

Verf. referiert AXHAUSENS Theorien über die Pathogenese der Epiphyseonekrosen, zu denen auch Osteochondritis dissecans gezählt wird. Der Osteochondritis dissecans wie auch PERTHES', KÖHLERS und KIENBÖCKS Krankheit liegt nach AXHAUSEN eine auf embolischem Wege entstandene aseptische Knochennekrose zugrunde. Die verschiedenen Röntgenbilder bei diesen Krankheitszuständen beruhen nur auf verschiedenen sekundären Veränderungen im nekrotischen Knochen, was mit ungleichen Belastungsverhältnissen in den einzelnen Gelenken zusammenhängt.

Verf. hat vergleichende röntgenologische Studien über die operativ entfernten Gelenkmäuse und über entsprechende Veränderungen in den Gelenkflächen bei Osteochondritis dissecans und bei sog. traumatischen Gelenkmäusen angestellt. Die Untersuchungen haben gezeigt, dass die Gelenkmäuse bei Osteochondritis dissecans eine röntgenologische Struktur aufweisen, die von anderen Formen der Gelenkmaus abweicht, und dass die röntgenologischen Veränderungen in den Femurkondylen für Osteochondritis dissecans spezifisch sind.

Eine Abgrenzung der Osteochondritis dissecans als ätiologisch getrennte Gruppe der freien Gelenkkörper scheint mithin auch durch die röntgenologischen Befunde gerechtfertigt zu sein.

## SUMMARY

The author gives an account av AXHAUSEN's theories with regard to the epiphyseal necroses, among which also Osteochondritis dissecans is included. The origin of the latter affection — as well as of PERTHES', KOEHLER's and KIENBOECK's diseases — is to be found, according to AXHAUSEN, in an aseptic necrosis of the bone, resulting from an embolism. That each of the diseases named

presents a different roentgenologic picture, is due only to differences in the secondary changes in the necrosed bones, to a certain extent accounted for by the different strain, or weight, which the joints in question are called upon to support.

The author has made comparative roentgenological studies of surgically removed sequestra and the corresponding changes in the joint surfaces in cases of osteochondritis dissecans, and of the so-called traumatic sequestra. His investigations have shown that the sequestra in cases of osteochondritis dissecans have a different roentgenologic structure from other forms of sequestra, and that the roentgenologic changes in the condyle of the femur are specific for osteochondritis dissecans.

To regard the osteochondritis dissecans as an etiologically separate group of the free joint formations would therefore seem to be justified, also on the basis of the roentgenologic findings.

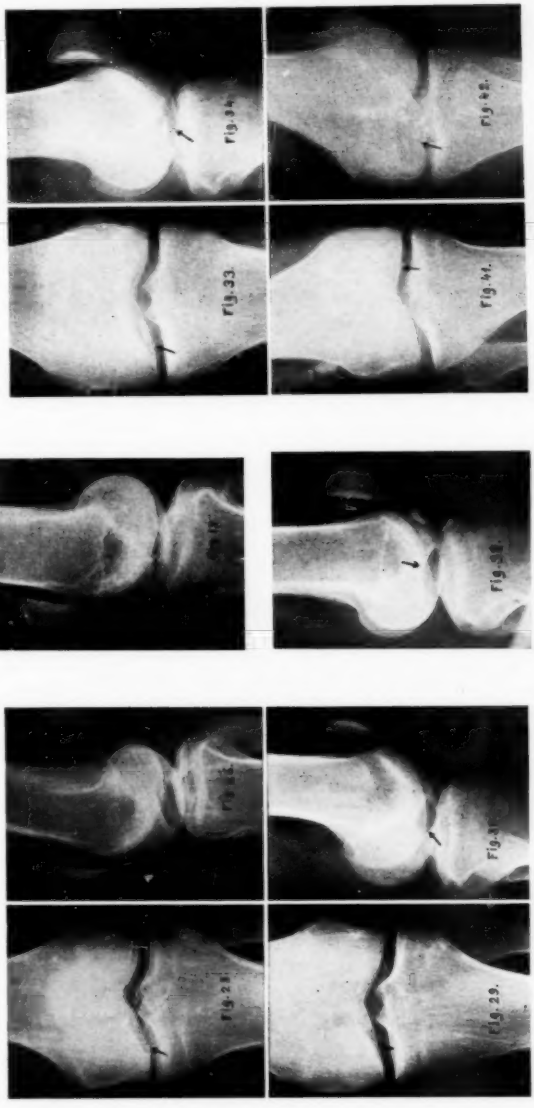
## RÉSUMÉ

L'auteur relate les théories d'AXHAUSEN sur la pathogénie des nécroses épiphysaires, parmi lesquelles il range aussi l'ostéochondrite disséquante. A la base de cette dernière, comme à la base des maladies de PERTHES, de KÖHLER et de KIENBÖCK il y a, d'après AXHAUSEN, une nécrose osseuse aseptique, suite d'embolie. La variété des images radiographiques dans ces états pathologiques est simplement due aux différences que présentent les altérations secondaires au niveau de l'os nécrosé ces différences tenant aux conditions statiques particulières à chaque jointure.

L'auteur a fait une étude radiologique comparative des »souris articulaires« enlevées par opération et des modifications correspondantes au niveau des surfaces articulaires, soit dans l'ostéochondrite disséquante, soit dans le cas de »souris articulaires» dites traumatiques. Les examens ont montré que les corps libres de l'ostéochondrite disséquante présentent une structure radiologique différente de celle d'autres formes de souris articulaires, et que les altérations radiologiques au niveau des condyles du fémur sont spécifiques pour l'ostéochondrite disséquante.

Du point de vue des données radiologiques aussi, il paraît donc légitime de mettre à part l'ostéochondrite disséquante et d'en faire un groupe de corps libres articulaires à étiologie propre.

*Tabula I*



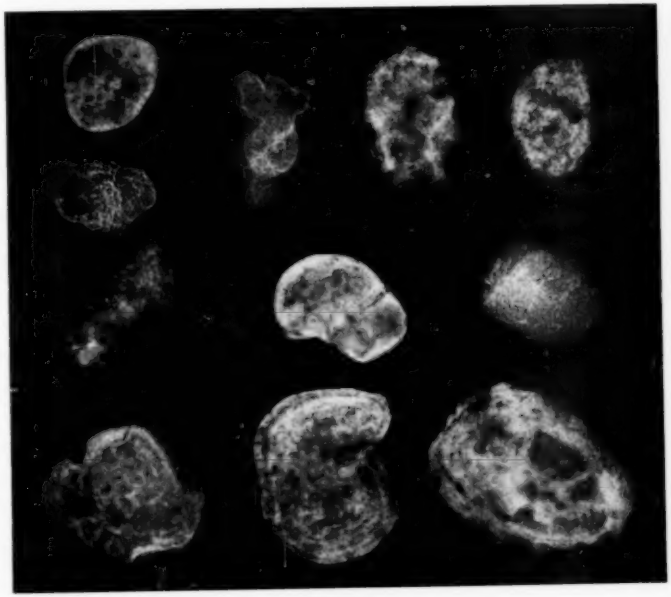
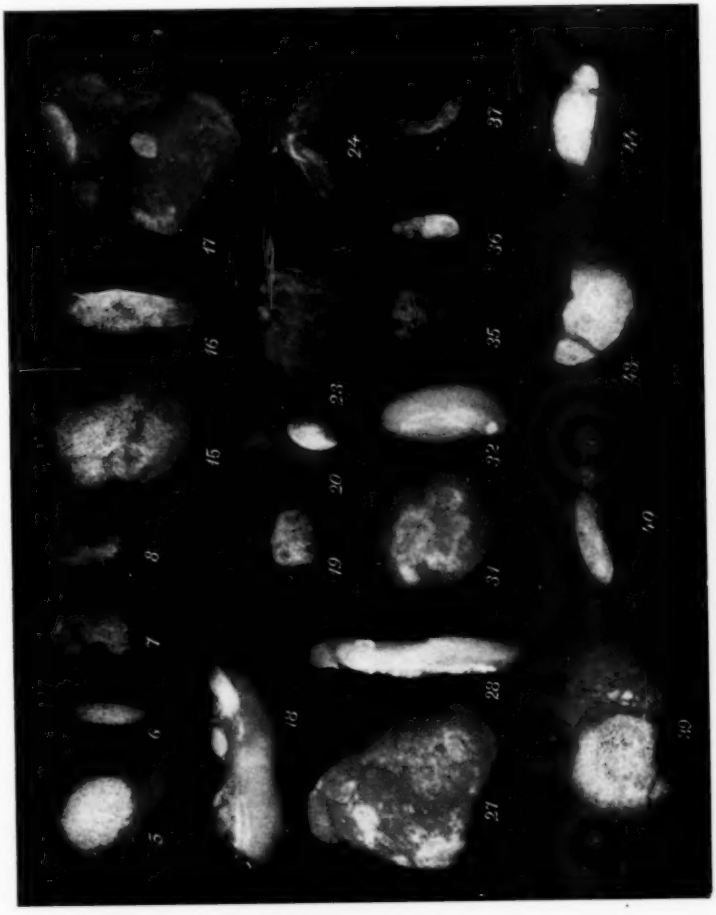


Fig. 45.

*Tabula III*


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37

*Tabula IV*

# ON THE HORISONTAL ORTHOPROJECTION OF THE HEART[1]

by

*T. Klason*

## I. Introduction and Anatomical Investigations

In 1922, and in a more detailed paper in 1924, I submitted the results of an investigation into the position of the cardiac rooms as seen in the orthodiagram at different projections and described a new method for the roentgenological examination of the heart. In the present paper I shall only briefly describe my investigations and the results obtained.

The chief thing in radiological examination of the heart is always to know where the different cardiac rooms are situated within the cardiac shadow. The opinions of different authors differ here in certain aspects of the question. In order to gain some original knowledge of the position of the cardiac rooms at different projections I found it became necessary to, have resource, to anatomical investigations. For this purpose I examined one series of horisontal and another series of sagittal frozen sections of the thorax, in addition to a detailed examination of 5 post-mortem cases in which the heart had been fixed in situ. In order to get familiar with the anatomical details we are concerned with here, frozen sections make up a suitable starting-point. Figures 1 and 2 show the appearance of a horisontal section through the thorax in the neighbourhood of the heart apex. It will be seen that the whole of the left ventricle is situated to the left of the mid-line and that this room forms the left as also the posterior boundary of the heart as far as to the mid-line. The left auricle is not involved in the section and cannot therefore in the lateral positions partake in the contour formation of the heart as far down as to the diaphragm. The right auricle, somewhat collapsed, has been hit in its lower part just above the point of entrance of the inferior vena cava. In a horisontal section, about 3 cm. higher up, the right ventricle, fig. 3, has been hit in its greatest or almost greatest diameter.

[1] From the Second International Congress of Radiology at Stockholm 1928.

Fig. 1. Horisontal section through the thorax in the neighbourhood of the heart apex seen from above. Index indicates 5 cm.

This cardiac room is situated most ventrally and makes up the largest part of the ventral surface of the heart. It also reaches higher up than the left ventricle, which is partly encircled by the right ventricle from the front. This condition is best illustrated by a sagittal section somewhat to the left of the mid-line (fig. 4) and by a similar section of a heart

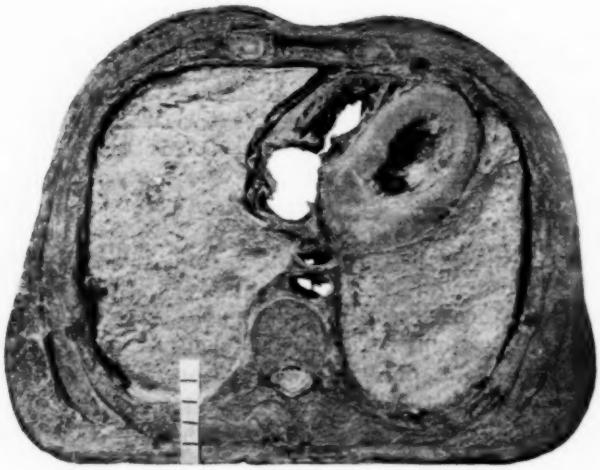


Fig. 2. The same section as in fig. 1 but seen from below.

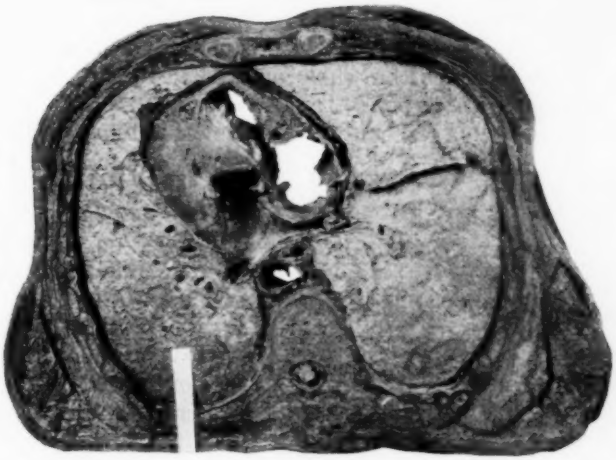


Fig. 3. Horisontal section through the thorax 3 cm. above the apex of the heart.

fixed in situ (fig. 5). On the horisontal section about 3 cm. above the apex (fig. 3) the right auricle is further seen to be hit in its greatest diameter and the left auricle involved near its lower part on level with the two lower pulmonary veins. This room is found fairly equally distributed over the two sides of the mid-line and of the 4 rooms also extends farthest in a cranial direction (see fig. 6 representing a median section through the thorax seen from the right). The following, then, is the localisation of the four cardiac rooms within the heart: the left auricle is hind-most and equally distributed over the two sides of the mid-line and extends farthest cranially of the four rooms. It never reaches as far down as to the diaphragm. The right auricle is situated to the right and makes up the greatest part of the right border of the heart. The left ventricle is found to the left and also at the back forming a great portion of the left surface of the heart; finally the right ventricle is situated ventrally between the right auricle and the left ventricle.

Besides the study of these frozen sections I have studied in various ways 5 hearts fixed in situ; the result will be found in fig. 7 showing diagrammatic drawings of the borders of the cardiac rooms on the cardiac surface in different positions, among which will also be found the heart seen from above. For the sake of clearness the borders of the heart have been drawn with full lines on the parts of the heart facing the examiner, and with dotted lines on the other parts of the cardiac surface.

Guided by these pictures it is easy to understand which rooms of the heart partake in the contour in the various projections. In the

initial position, the frontal, is it only the right auricle and the left ventricle that take part in the contour. The right auricle is mostly free in this position and forms the whole of the right contour but the right ventricle reaches very near point, D, (fig. 7) and this room may possibly at times partake in forming the contour here under normal conditions. Most authors, however, deny this. The left part of the cardiac shadow is mostly formed by the left ventricle but it must be remembered that this room is facing more backwards than forwards and only a more or less wide portion of it along the septum ventriculorum takes part in the contour in a frontal picture. The angle between the left ventricle and the conus arteriosus and its prolongation, arteria pulmonalis, can be seen filled up by a shadow more or less clear in differ-

Fig. 4. Sagittal section immediately to the left of the sternum and spinal column. In this figure the section passes on the lateral aspect of the mitral valve and somewhat more laterally than the section in fig. 5. The cut surface is seen from the left.

Fig. 5. Sagittal section through the heart, somewhat more medially than in fig. 4. V.D. and V.S. right and left ventricles.

ent cases, first described by WEIMBERGER and HOLTZKNECHT. This shadow is made up of the left auricular appendix.

The best mode of procedure in examining the heart is first to rotate the patient from the initial position under simultaneous screening in such a direction that his left shoulder approaches the examiner and then in the opposite direction from the initial position, in both cases $^1/_4$ of a circle, observing in the meantime how the pulsations and the configuration of the cardiac shadow alter.

If we thus rotate the patient from the initial position so that his

left shoulder approaches the examiner and continue the rotation to 90 degrees, it will first be seen on the left how the ventricular pulsations become more powerful, due to the fact that the free surface of the ventricle is pulsating stronger than the part of it situated closer to the septum. At a relatively small angle of rotation the left contour of the heart is covered by the shadow of the spinal column but at an angle of 30°—40° they get clear of each other and the outline of the heart can again be seen. One can now see above the left ventricle a thinner portion of the cardiac shadow not so well defined; this shadow is made up of the left auricle. The boundary between these two rooms passes obliquely across the posterior cardiac surface and on continuous rotation a gradually greater part of the cardiac contour will be formed by the left auricle. As already stated, however, this cardiac room never reaches as far down as the diaphragm but just above it a part of the left ventricle can be seen even in purely lateral positions. The boundary between these two cardiac rooms is often marked out by a small node used by LAUBRY, MALLET and HIRSCHBERG as the initial point for some measurements of the left auricle. If instead during this rotation we examine the right outline of the heart, the right ventricle will already at a small angle of rotation take part in the contour just above the diaphragm and on continued rotation a gradually greater portion of the border of the cardiac shadow will be formed by the right ventricle. At which angle the right auricle no longer takes part in the contour formation cannot be definitely ascertained. In a purely lateral position, however, the right auricle probably does not take part in the contour formed below by the ventral walls of the two ventricles projected above one another, and higher up by the ventral wall of the right ventricle,

Fig. 6. Sagittal section through the thorax seen from the right.

continued by the pulmonary artery in the shape of a slightly convex arch. Farthest down it is impossible in lateral position to define on the screen with certainty any sharp limit between the heart and the sternum but higher up the heart is surrounded by air-containing lungs and it is easy in this position to study the pulmonary artery and the upper part of the ventral surface of the right ventricle.

When the patient is rotated from frontal position in the opposite direction, so that his right shoulder comes to approach the examiner, the following conditions will prevail. On the left side the left auricular appendix will soon disappear and the contour be formed more and more by the pulmonary artery and the conus arteriosus on the expense of the left ventricle, and in a true lateral position the cardiac outline will be made up below, as previously mentioned, of the ventricular walls projected above each other, higher up of the ventral surface of the right ventricle. On the right side things will become more complicated. The outline is at first formed by the right auricle. On rotation the shadow of the spinal column will soon cover the heart; on further rotation, however, these will get clear of each other and in some cases one can now see in the angle between the heart and the diaphragm a fairly straight contour, about 1—2 cm. in length, cutting off a portion of this angular apex. This contour is seen more clearly on inspiration and is formed by the inferior vena cava. When the shadows of the heart and spinal column have got clear of one another, a slight prominence can often be seen on level with and somewhat below point D; this prominence is formed by the left auricle as stated by ATTINGER, ASSMAN, BORDET & VAQUEZ and DIETLEN. This dilatation is more obvious in the case of the left auricle being enlarged and on marked enlargement of this room it may form in frontal position a contour to the left as well as to the right. On continued rotation a gradually bigger portion of the cardiac contour will be formed by the left auricle on the expense of the right and on still further rotation can be seen just above the diaphragm systolic pulsations originating from the left ventricle. The left ventricle can often be seen through the right auricle before forming any definite contour. In true lateral position, however, the right auricle has no longer any share in the contour formation, made up above the diaphragm as already stated, by the left ventricle and above this by the left auricle. If the patient initially be placed with his back towards the examiner, the conditions will be reflected images of those just stated. The heart, however, will come further away from the screen and will not be so sharply defined, wherefore this position is not very often used. A right posterior oblique position, however, may be employed with advantage for the study of the left auricle.

These conditions referring to the outlines of the heart have already for long been known, yet I have dealt with them here in greater detail

because of their importance for the right understanding of my special technique.

## II. The Author's Special Technique

In a roentgenological examination of a heart one should aim at trying to ascertain whether its size lies within normal limits or whether the relative size of one or several cardiac rooms has undergone any changes. In order to do this it is necessary to form as sound an opinion as possible of the volume of the heart which can be done by studying the appearance of the heart in different projections; in so doing one is greatly helped by the author's mode of projection which is an orthoprojection of the heart on a horisontal plane.

My method is to some extent a simplification of PALMIERI's »Radioplastik» although by a special mode of procedure the technique I employ has been further developed and the whole reconstruction made almost automatic. Without entering upon the simple theoretical principles on which the method is based, a brief description of the technique will be given below. Fig. 16.

In a screening stand a revolving chair is placed at a certain distance from the tube, or some other device, by which the patient can be rotated round a definite vertical axle, the latter, if possible, passing through the centre of the heart. A horisontal top is mounted above the stand and a pin attached to the point of contact between the prolongation of the rotatory axle and the roof; to the upper end of this pin a horisontal wooden disk is attached. The pin is connected with the revolving chair and it is readily understood that in rotation of the chair the horisontal wooden disk will take part in the movement. A bromium-silver paper, 24 × 30 cm., is placed on the top of this disk with its sensitized side uppermost. Vertically above the focus of the tube a vertical rod is mounted on the upper side of the roof and round this rod a ruler can be rotated in the horisontal plane immediately above the bromium-silver paper. At the point of intersection between the ruler and the paper the former is cut through along its mid-line and above this cut a small box is mounted on the ruler containing an electric lamp, the switch of which the examiner holds in his hand. Along the upper border of the screening stand and on the side facing the patient a horisontal metal rod is attached serving as a guide to a vertical metal rod, the lower end of which extends down to the lower border of the screening stand and the upper end of which is fitted into a corresponding notch in the outer end of the ruler already referred to. It will be readily understood now that when this vertical rod is shifted along the posterior surface of the screen from one border to the other, the movement will be transmitted to the above ruler which

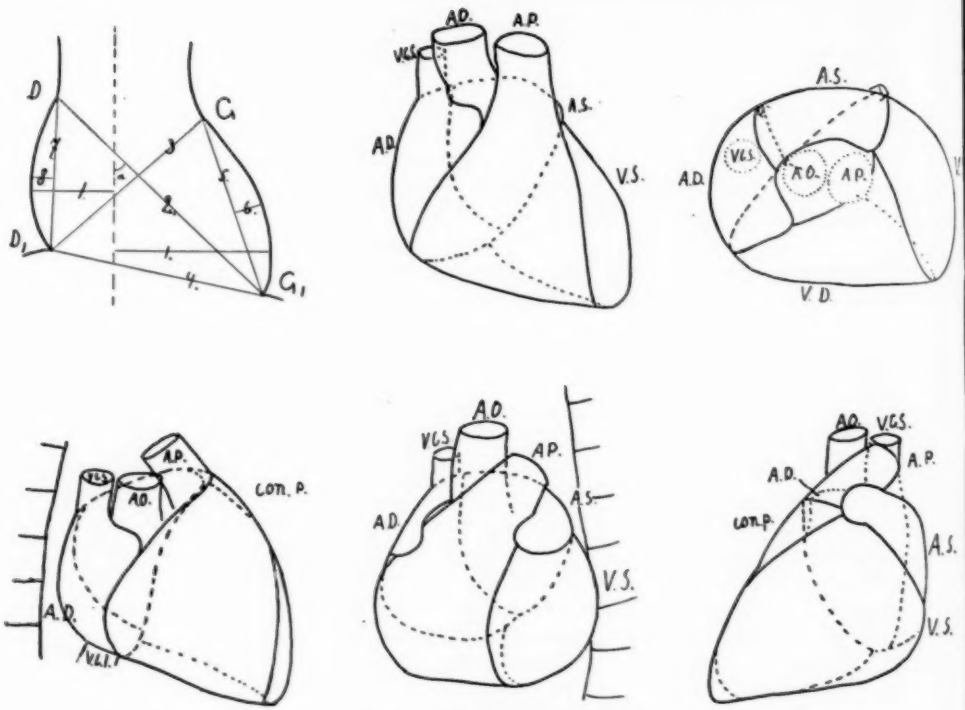



Fig. 7. *Diagrams of the heart.*

| | | |
|---|---|---|
| Diagram of the different cardiac measurements. | Heart seen from the front. | Heart seen from above. Its ventral part is here facing downwards. |
| The heart in right anterior oblique position. | The heart in left anterior oblique position. | The heart seen from the left. |

*Abbreviations:* D and $D_1$, upper and lower points of the right auricle. G and $G_1$, upper and lower points of the left ventricle. AD, right auricle. AS, left auricle. VD, right ventricle. VS, left ventricle. Con.p, conus arteriosus. AO, aorta. A.P., pulmonary artery. Vcs. and Vci. vena cava superior and inferior.

will rotate in the horisontal plane immediately above the disk on which the bromium-silver paper is placed. With the patient placed on the revolving chair and the vertical rod so shifted that its shadow coincides with the most lateral point of the cardiac shadow the mid-line of the ruler will be found in the same direction and vertically above the tangent from the focus of the tube to the most lateral point of the cardiac surface. To obtain an orthoprojection of the heart on a horisontal plane it is sufficient, therefore, to revolve the patient through 360° and at regular intervals switch on and off the small lamp, all the time letting the

shadow of the vertical metal rod coincide with the most lateral point of the cardiac shadow. On developing the paper a mass of lines will be seen crossing each other under very obtuse angles delimiting the desired projection. Fig. 16. If in addition one would like, as it were, to insert this projected figure in the thorax, the position of a piece of lead is marked out by the apparatus straight opposite the heart on the sternum as well as at the anterior edge of a dorsal vertebra on level with the heart; guided by these markers the orthoprojection of the heart can then be laid in a horisontal section of the thorax on level with the heart. The circumference of the thorax is most easily obtained by forming a strip of lead round the thorax on level with the heart.

Of course there are many other ways of transmitting the rotation of the patient and the position of the tangential ray to the heart, as for example by gears at the side of the screening stand but the method described would seem to be the simplest. For the method to be successful some practice is needed; the difficulties, however, are great because of the fact that the contour of the heart cannot be seen in all positions. To facilitate the reconstruction I have found it convenient starting from lateral positions to reconstruct the contour of the heart as far as possible in the direction of the sternum.

The orthoprojection then obtained shows the heart from above. It has a rounded egg-shape with the apex to the left and forwards. Its ventral part is somewhat flattened and its biggest sagittal diameter is found approximately in the mid-line of the body. Its biggest transverse diameter passes from the right obliquely forwards to the left. It is impossible by this method to show exactly the boundaries between the different rooms. A comparison with my anatomical investigations shows, however, that the anatomical section on which this projection is based will involve the four cardiac rooms in approximately their biggest diameters which explains the great diagnostic importance of this projection. Fig. 8 shows such an anatomical section through the heart seen from below. It will be seen that the ventral part of the horisontal projection is formed by the right ventricle which also forms a small portion of the right and left lateral parts of the projection. Its right part is made up of the right auricle and its left part of the left ventricle. In the midline behind the contour is formed by

Fig. 8. Section through the largest horisontal diameter of the heart, seen from below.

the left auricle. In this projection it is scarcely possible to submit any measurements corresponding to any anatomical details and in my table I have therefore been content with including only the largest sagittal measurement and the surface of the projection figure in sq.cm., normally varying between 70 and 105 cm². Fig. 9 shows frontal and lateral orthodiagrams of the thorax of a healthy person and the horisontal orthoprojection of the heart marked out in correct position on a horisontal section through the chest on level with the heart apex. For anatomical orientation these figures may be compared with fig. 7 and 8.

## §III. Examinations of 150 Normal Cases, with one Table

After this brief description of the author's special method 150 normal cases will be described, examined partly in the ordinary way and partly by the author's method.

In the estimation of the size and shape of a heart two problems present themselves for consideration as mentioned above. Firstly, how large ought the heart of the person to have been under normal circumstances and secondly, does any of the cardiac rooms deviate as regards to size from the others. It is not always possible exactly to answer these questions because so many factors influence the size of a heart that one often has to be content with saying that the size lies within or outside the normal limits of variation, and if the size in one case lies within the normal limits, it is impossible in the individual case to draw any definite conclusion from this. But if one gets the opportunity of examining a number of cases of the same etiology, it may be found, for instance, that some of the cardiac measurements often lie near the upper limit. Such is the case, as I have already shown, in early cases of so-called essential hypertonus and this naturally justifies one to conclude that the heart in these conditions is enlarged already at an early stage. The shape and size of a heart are much influenced by the position of the diaphragm, a fact that should always be considered; its size is further influenced by the blood quantity and in some cases I have been able to show that the orthodiagram increases in size after a more copious blood transfusion. Relatively rapid changes in the size of the heart may be met with after operations and in cases where patients with a much impaired condition rapidly recover; such cases, however, are exceptional and it may be said with a fairly great amount of certainty that so important an organ as the heart only undergoes slow alterations as to size and shape in connection with oncoming old age and nutrition.

Without a number of orthodiagrams of normal cases at one's disposal it will be necessary, when it is a question of analysing the shape and

size of the heart, to have resource to tables of normal cases. A number of such tables exist (BARDEN, BORDET & VAQUEZ, CLAYTOR & MERRIL, COHN, DIETLEN, TH. and F. M. GROEDEL, HAMMER, HAUDECK, HEYERDAHL, LIAN, MORITZ, OTTEN, SMITH, TEUBERN and many others). These tables agree on the whole well but their practical utility is not great, in part owing to the material not being arranged in the most convenient way. As an outcome of all the work expended in the making up of these tables it has been established, however, that the body weight is of decisive importance for the cardiac measurements while the height is of no very great moment (BARDEN, DIETLEN, HAMMER, W. MÜLLER, CLAYTOR & MERRIL, TEUBERN a. o.); further is it stated by BORDET & VAQUEZ that, other conditions being similar, an older person has a somewhat larger orthodiagram than a younger one. The different authors have arranged their material in a similar manner but common to them all is that the measurements within the different groups vary far too much. To give one instance only. It is being stated in COHN's tables that the horisontal diameter of the heart may vary by 5 cm. at a body weight of 75 kg.

My tables are founded on an investigation of 150 normal individuals, 100 men and 50 women. The measurements that ought to be used on the orthodiagram should correspond as much as possible with anatomical points on the cardiac surface, and those I have employed are on the whole the same as those used by BORDET & VAQUEZ and LIAN.

1. The biggest horisontal diameter.

2. The length of the orthodiagram, D—$G_1$. $G_1$ is the point where a line parallel with G—$D_1$ touches the heart tangentially.

These two measurements are an expression of the general size of the heart.

3. The diameter G—$D_1$. This passes approximately between auricles and ventricles, its length being mainly determined by the right ventricle.

4. The diameter $D_1$—$G_1$. This diameter is to some extent partly determined by the length of the lower border of the right ventricle, and it may be assumed with fairly great certainty that the right ventricle is enlarged when this measurement approaches the horisontal breadth of the heart.

5 and 6. The diameter G—$G_1$ and the largest distance from this line to the left cardiac contour. These two measurements first suggested by LIAN and BORDET & VAQUEZ are excellent measurements of the left ventricle.

7 and 8. The same measurements as in 5 and 6 but applied to the right auricle.

**Normal Measurements of the Frontal Orthodiagram and Horisontal**

Men. Body

| Age years | Height cm. | | 50—69 kilogram: Ordinary frontal orthodiagram: Horisontal diameter cm. | Length cm. | Auriculo-ventricular boundary cm. | Diameter of right ventricle just above the diaphragm cm. | Left ventricle cm. | Bend of left ventricular contour. cm. | Right auricle cm. | Bend of right auricular contour. cm. | Transverse internal diameter of thorax cm. | Sloping angle of the heart degr. | Horisontal orthodiagram: Sagittal measurement cm. | Surfac in sq.cm. cm.² | 70—79 kilogram: Ordinary: Horisontal diameter cm. | Length cm. | Auriculo-ventricular boundary cm. | Diameter of right ventricle just above the diaphragm cm. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | | | | 1 | 2 | 3 | 4 |
| | 167— | min. | 10.5 | 11.5 | 9 | 9 | 6.5 | 12 | 6.5 | 7 | 23 | 38 | 9 | 83 | 11.5 | 12.5 | 10 | 9 |
| | 173 | max. | 13.5 | 15 | 11.5 | 12 | 9.5 | 18 | 8 | 14 | 27 | 50 | 9.8 | 107 | 13 | 14 | 10 | 11.5 |
| | | med. | 11.9 | 13.9 | 9.9 | 10.6 | 7.6 | 14.8 | 7.3 | 10.9 | 24 | 44 | | | 12.1 | 13.5 | 10 | 10.1 |
| 20 | 174— | min. | 10.5 | 12.5 | 9.5 | 9 | 7 | 11 | 6.5 | 9 | 21 | 40 | 9.5 | 83 | 11.5 | 12.5 | 10 | 9.5 |
| to | 180 | max. | 12 5 | 14.5 | 11 | 11.5 | 10 | 17 | 9 | 12 | 25 | 50 | 10.8 | 105 | 12.5 | 13.5 | 11 | 11.5 |
| 29 | | med. | 11.6 | 13.2 | 10.1 | 10.3 | 8.4 | 14.2 | 7.6 | 11.3 | 23 | 43 | | | 12.1 | 13.3 | 10.5 | 10.7 |
| | 181— | min. | 10.5 | 13 | 9.5 | 9 | 7.5 | 13 | 7.5 | 10 | 25 | 35 | 9.5 | 83 | 10 | 12 | 8.5 | 9.5 |
| | | max. | 12 | 13.5 | 9.5 | 10.5 | 8 | 17 | 8.5 | 14 | 25.5 | 38 | 9.8 | 91 | 13 | 14 | 11 | 12 |
| | | med. | 11.5 | 13.2 | 9.5 | 9.7 | 7.7 | 15 | 8 | 12 | 25 | 36 | | | 11.8 | 13.2 | 9.9 | 10.6 |
| | 167— | min. | 11 | 12.5 | 9 | 10 | 7.5 | 13 | 7 | 7 | 24 | 50 | 9 | 82 | 12.5 | 13.5 | 9.5 | 12 |
| | 173 | max. | 13 | 13.5 | 10.5 | 11.5 | 8 | 18 | 7.5 | 13 | 27 | 55 | 9.5 | 100 | 14 | 14.5 | 11 | 12.5 |
| | | med. | 11.8 | 13 | 10 | 11 | 7.7 | 14.7 | 7.1 | 9.2 | 25 | 52 | | | 13.2 | 14.2 | 10.2 | 12.2 |
| 30 | 174— | min. | 11.5 | 13 | 9.5 | 10.5 | 7 | 11 | 5.5 | 5 | 23 | 40 | 9.5 | 87 | 12 | 13 | 10 | 10.5 |
| to | 180 | max. | 13 | 14 | 10 | 12.5 | 7.5 | 14 | 7.5 | 9 | 27 | 50 | 9.0 | 92 | 13 | 14 | 11 | 12 |
| 39 | | med. | 12.2 | 13.5 | 9.7 | 11.5 | 7.2 | 12.5 | 6.5 | 7 | 25 | 45 | | | 12.6 | 13.7 | 10.3 | 11.3 |
| | 181— | min. | | | | | | | | | | | | | 11 | 12.5 | 10.5 | 9.5 |
| | | max. | | | | | | | | | | | | | 12.5 | 14.5 | 11 | 12 |
| | | med. | 9.5 | 13 | 8.5 | 9 | 8.5 | 12 | 7.5 | 8 | 25 | 38 | 9 | 71 | 11.9 | 13.2 | 10.6 | 10.7 |
| | 167— | min. | 9.4 | 12.7 | 9.2 | 9.7 | 7.5 | 13 | 6.5 | 6 | 19 5 | 40 | 8.5 | 75 | 11 | 12 | 9.5 | 10.5 |
| | 173 | max. | 12.5 | 14 | 10 | 12 | 8.5 | 14.9 | 7 | 9.2 | 25 | 44 | 9.5 | 91 | 13.5 | 13.5 | 11 | 12 |
| | | med. | 11.1 | 12.7 | 9.9 | 11 | 7.8 | 14 | 7 | 9 | 24 | 46 | | | 12.3 | 12.8 | 10 | 11.3 |
| 40 | 174— | min. | | | | | | | | | | | | | 12 | 12.5 | 9.5 | 11 |
| to | 180 | max. | | | | | | | | | | | | | 13.5 | 14.5 | 10.5 | 12 |
| 49 | | med. | | | | | | | | | | | | | 12.5 | 15.7 | 10.1 | 11.2 |
| | 181— | min. | | | | | | | | | | | | | 11.5 | 12.5 | 9.5 | 10 |
| | | max. | | | | | | | | | | | | | 12.5 | 14 | 10 | 12 |
| | | med. | | | | | | | | | | | | | 12 | 13.1 | 9.5 | 11 |
| | 167— | min. | 10.8 | 11.7 | 9.4 | 10 | 7.8 | 12 | 6.5 | 6 | 23.5 | 43 | 9.5 | 83 | | | | |
| | 173 | max. | 12.2 | 12.8 | 10.8 | 12 | 8.5 | 12 | 7 | 9 | 26 | 45 | 9.8 | 105 | | | | |
| | | med. | 11.6 | 12.5 | 9.9 | 11.1 | 7.9 | 11 | 6.5 | 8 | 24.5 | 48 | | | 14 | 15 | 10 | 14 |
| 50 | 174— | min. | | | | | | | | | | | | | 12 | 13 | 10 | 11.2 |
| to | 180 | max. | | | | | | | | | | | | | 13 | 13.8 | 10.5 | 12 |
| 59 | | med. | 12 | 12.6 | 10.2 | 10.5 | 9 | 18 | 8.5 | 13 | 23 | 45 | 9 | 84 | 12.5 | 13 | 10.1 | 11.5 |
| | 181— | min. | | | | | | | | | | | | | | | | |
| | | max. | | | | | | | | | | | | | | | | |
| | | med. | | | | | | | | | | | | | | | | |

**Orthoprojection of the Heart in Men and Women.**

| Weight | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| kilogram | | | | | | | | 80 kilogram | | | | | | | | | | | |
| frontal orthodiagram | | | | | | Horisontal orthodiagram | | Ordinary frontal orthodiagram | | | | | | | | | Horisontal orthodiagram | | |
| Left ventricle | Bend of left ventricular contour. | Right auricle | Bend of right auricular contour. | Transverse internal diameter of thorax | Sloping angle of the heart | Sagittal measurement | Surface in sq.cm. | Horisontal diameter | Length | Auriculo-ventricular boundary | Diameter of right ventricle just above the diaphragm | Left ventricle | Bend of left ventricular contour. | Right auricle | Bend of right auricular contour. | Transverse internal diameter of thorax | Sloping angle of the heart | Sagittal measurement | Surface in sq.cm. |
| cm. | cm. | cm. | cm. | cm. | degr. | cm. | cm.² | cm. | cm. | cm. | cm. | cm. | cm. | cm. | cm. | cm. | degr. | cm. | cm.² |
| 5 | 6 | 7 | 8 | | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | | | |
| 7.5 | 13 | 7.5 | 11 | 24 | 40 | 8 | 78 | | | | | | | | | | | | |
| 8 | 17 | 8 | 14 | 29 | 55 | 9 | 88 | | | | | | | | | | | | |
| 7.8 | 14.6 | 7.6 | 12 | 25.8 | 47 | | | 13 | 13.5 | 11 | 12 | 8 | 17 | 6.5 | 11 | 24.5 | 50 | 9.5 | 103 |
| 7 | 12 | 6 | 10 | 25.5 | 40 | 9 | 75 | 13 | 14 | 10.5 | 12 | 7.5 | 14 | 7 | 10 | 26 | 49 | 11 | 120 |
| 9 | 20 | 9 | 15 | 26 | 46 | 9.5 | 105 | 13 | 14 | 11 | 12 | 9 | 15 | 7 | 10 | 26.5 | 50 | 11.5 | 124 |
| 7.9 | 15.5 | 7.6 | 11.8 | 25 | 42 | | | 13 | 14 | 10.7 | 12 | 8.2 | 14.5 | 7 | 10 | 26 | 49 | | |
| 6 | 10 | 7 | 7 | 24 | 37 | 9 | 75 | 12 | 13 | 8.5 | 10.5 | 8 | 13 | 6 | 6 | 26 | 40 | 9.7 | 93 |
| 9 | 18 | 8.5 | 16 | 27 | 50 | 9.8 | 104 | 14 | 14 | 11.5 | 13.5 | 8.5 | 17 | 8 | 15 | 30.5 | 55 | 11 | 121 |
| 7.8 | 14.1 | 7.4 | 11 | 25 | 43 | | | 12.5 | 13.6 | 10.2 | 11.4 | 8.2 | 15.6 | 7.1 | 10.5 | 27.4 | 47 | | |
| 7 | 12 | 6.5 | 8 | 24 | 49 | 10 | 110 | | | | | | | | | | | | |
| 8.5 | 20 | 7 | 11 | 26 | 55 | 10 | 116 | | | | | | | | | | | | |
| 7.8 | 15 | 6.9 | 8.7 | 25 | 49 | | | 12 | 13.5 | 10.5 | 11 | 7 | 14 | 8 | 9 | 27 | 40 | 9.5 | 98 |
| 7.5 | 14 | 6.5 | 7 | 25 | 40 | 9.5 | 95 | 11.5 | 13.5 | 9.5 | 11 | 7.5 | 16 | 6.5 | 7 | 25.5 | 48 | 9.5 | 94 |
| 9.5 | 19 | 8.5 | 14 | 27.5 | 50 | 9.7 | 98 | 14.5 | 14.5 | 11 | 13 | 9 | 18 | 7.5 | 13 | 26.5 | 58 | 9.7 | 105 |
| 8.4 | 16.1 | 7.5 | 11.4 | 26 | 45 | | | 13 | 14 | 10.3 | 11.8 | 8.2 | 17.3 | 7.2 | 9.3 | 25.8 | 52 | | |
| 7.5 | 13 | 5.5 | 5 | 24.5 | 38 | 8.5 | 79 | 12.5 | 14 | 11 | 11.5 | 8 | 15 | 7.5 | 8 | 26.5 | 40 | 9 | 95 |
| 9.5 | 18 | 9 | 14 | 28.5 | 50 | 10.5 | 107 | 13.5 | 15 | 11.5 | 12 | 9 | 17 | 9.5 | 15 | 29 | 50 | 11 | 125 |
| 8.6 | 15.5 | 7.5 | 9.6 | 25.9 | 44 | | | 13 | 14.3 | 11.1 | 11.8 | 8.5 | 15.6 | 8.1 | 11 | 27.5 | 49 | | |
| 8 | 13 | 5.5 | 7 | 24 | 50 | 8.3 | 77 | | | | | | | | | | | | |
| 8 | 19 | 6.5 | 7 | 28.5 | 50 | 10 | 110 | | | | | | | | | | | | |
| 8 | 13.3 | 6.5 | 8 | 25.8 | 50 | | | | | | | | | | | | | | |
| 7 | 14 | 5.5 | 7 | 26 | 50 | 9 | 83 | 13 | 14 | 10 | 12 | 8 | 12 | 8.5 | 6 | 26 | 45 | 10 | 102 |
| 9 | 17 | 7.5 | 12 | 28 | 50 | 10.8 | 123 | 14 | 15 | 10.5 | 13.5 | 9 | 14 | 7 | 11 | 27.5 | 58 | 10.5 | 129 |
| 8.1 | 15 | 7.2 | 8.6 | 26.4 | 44 | | | 13.5 | 14.5 | 10.3 | 12.7 | 8.5 | 13 | 7.7 | 8.5 | 26.5 | 51 | | |
| 8 | 16 | 6.5 | 8 | 23.5 | 45 | 8.3 | 82 | 13.5 | 14.5 | 10 | 13 | 7.5 | 10 | 6.5 | 6 | 26 | 50 | 10 | 105 |
| 8.5 | 12 | 6 | 8 | 26 | 53 | 10.5 | 111 | 14 | 14.5 | 10.5 | 13 | 8 | 17 | 6.5 | 9 | 26.5 | 50 | 10.5 | 107 |
| 8.2 | 14 | 6.2 | 8 | 24.7 | 48 | | | 13.5 | 14.5 | 10.5 | 13 | 7.7 | 13.5 | 6.5 | 7.5 | 26 | 50 | | |
| 8 | 13 | 5.5 | 5 | 27 | 57 | 9.5 | 107 | | | | | | | | | | | | |
| 8.5 | 12 | 26 | 48 | 23 | 48 | 9 | 87 | | | | | | | | | | | | |
| 8 | 12 | 24 | 55 | 26 | 50 | 10 | 94 | | | | | | | | | | | | |
| 7.9 | 13 | 25 | 50 | 24.5 | 49 | | | 14 | 15 | 11 | 13.5 | 7 | 13 | 8.5 | 10 | 25 | 50 | 10 | 104 |
| | | | | | | | | 13 | 13.5 | 10 | 12 | 8 | 12 | 6 | 6 | 26.5 | 50 | 9.8 | 99 |
| | | | | | | | | 13 | 14.6 | 10.5 | 12.8 | 9 | 10 | 7 | 8 | 27 | 58 | 11 | 107 |
| | | | | | | | | 13 | 14 | 9.9 | 12.6 | 8.4 | 11 | 6.3 | 7 | 27 | 55 | | |

Women. Body

| Age years | Height cm. | | 40—49 kilogram | | | | | | | | | | | | 50—59 kilogram | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | | | |
| 20 to 30 | 155—162 | min. | | | | | | | | | | | | | 9.5 | 11 | 8.5 | 9 | 6 | 10 | 5 | 5 | 21 | 45 | 8 | 65 |
| | | max. | | | | | | | | | | | | | 11 | 12.5 | 9.5 | 10 | 7.2 | 11 | 9.4 | 15 | 21 | 45 | 8.8 | 80 |
| | | med. | 9.5 | 11 | 8 | 9.5 | 6 | 10 | 5 | 5 | 21 | 45 | 7.3 | 61 | 10.5 | 11.8 | 9.8 | 9.6 | 7 | 11.8 | 8.5 | 9.7 | 21 | 43 | | |
| | 163—170 | min. | | | | | | | | | | | | | 8.5 | 10 | 8 | 8 | 6.5 | 10 | 5 | 4 | 19.5 | 42 | 7.3 | 56 |
| | | max. | | | | | | | | | | | | | 12 | 12.5 | 10 | 10 | 8 | 14 | 8 | 11 | 24 | 45 | 9.3 | 93 |
| | | med. | 10 | 12 | 8.5 | 7.5 | 7 | 10 | 8 | 12 | 20.5 | 43 | 8.2 | 65 | 9.5 | 10.9 | 8 | 8.5 | 7 | 11.1 | 6.4 | 9.4 | 21.5 | 43 | | |
| | 171—178 | min. | | | | | | | | | | | | | 9.5 | 11 | 9 | 8 | 8 | 14 | 7 | 9 | 21 | 38 | 7.3 | 60 |
| | | max. | | | | | | | | | | | | | 11 | 13.5 | 9.5 | 10 | 8.5 | 14 | 7.5 | 11 | 24.5 | 40 | 8.5 | 81 |
| | | med. | | | | | | | | | | | | | 10.2 | 12.2 | 9.2 | 9 | 8.2 | 14 | 7.2 | 10 | 22.7 | 39 | | |

In the next column will be found the biggest internal thoracic diameter and in the column after that the angle of incidence of the heart. According to TH. KREUZFUCHS and his follower TH. GROEDEL there exists a definite relationship between the latter measurement and the horisontal transverse diameter of the heart, in persons of 20, 1 : 1.92 and in persons of 30, 1 : 1.95. The knowledge of this relationship may sometimes be of value when wishing to make a rapid estimation of the general size of a heart; the discrepancies, however, will be found considerable and for a closer analysis of the shape of the heart the measurement is insufficient.

Finally I have included the sagittal diameter of the heart's horisontal orthoprojection and its surface measured in square centimeters.

In arranging the material this may either be done on the basis of the orthodiagrams or of the body weight and height. As usual before now I have followed the latter principle but contrary to a good many other authors I have arranged my material in one comprehensive table according to age, height and body weight. I do not propose in this relation to enter upon any discussion of my figures, the purpose of which has only been to give the approximate limits of variation for the different measurements. One thing should be mentioned, however, as it does not seem to be clearly in evidence in other tables. In cases of great discrepancy between height and weight, to wit great height and small weight, the orthodiagram will as a rule be found to be smaller than in cases with the same weight but with a height more consistent with the weight.

In spite of the small material I think the table may be of good use in the analysis of a heart but it must be remembered that in spite of normal measurements the heart may nevertheless be the seat of muscular as well as valvular changes.

| Weight | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 60—69 kilogram | | | | | | | | | | | | 70 kilogram— | | | | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | | | |
| 11 | 11.5 | 9 | 9.5 | 7.5 | 14 | 6.5 | 9 | 23 | 43 | 8.2 | 73 | 12 | 13.5 | 9.5 | 10 | 7 | 14 | 6 | 7 | 23 | 43 | 8.8 | 86 |
| 11.5 | 13 | 9.5 | 10.5 | 7.5 | 15 | 7.5 | 11 | 23 | 48 | 8.8 | 84 | 13 | 14 | 9.5 | 12.5 | 8 | 15 | 7.5 | 11 | 23 | 55 | 10 | 108 |
| 11.2 | 12.3 | 9.1 | 10.3 | 7.6 | 14.6 | 6.8 | 9.6 | 22 | 43 | | | 12.5 | 13.7 | 9.5 | 11.3 | 7.5 | 14.5 | 6.7 | 9 | 23 | 49 | | |
| 9.5 | 11 | 8 | 9 | 7 | 10 | 5.5 | 5 | 20 | 44 | 8 | 64 | | | | | | | | | | | | |
| 13 | 13.5 | 9.5 | 12 | 8.5 | 17 | 6 | 10 | 24 | 47 | 9.5 | 104 | | | | | | | | | | | | |
| 11.3 | 12.6 | 9.1 | 10.4 | 7.6 | 15.6 | 6.5 | 8.8 | 22.6 | 44 | | | 11.5 | 12 | 9 | 10.5 | 8 | 17 | 5 | 7 | 23.5 | 55 | 9 | 93 |
| 10 | 12 | 8.5 | 9 | 7.5 | 13 | 7 | 9 | 22 | 42 | 8 | 70 | 11 | 12 | 9 | 8 | 7.5 | 17 | 5.5 | 7 | 23.5 | 46 | 9.2 | 85 |
| 12.5 | 13 | 9.5 | 11 | 8 | 14 | 7.3 | 13 | 23.5 | 51 | 10 | 97 | 12 | 12.5 | 10 | 11 | 9 | 19 | 6.5 | 7 | 25 | 50 | 9.5 | 98 |
| 10.9 | 12.6 | 9.2 | 9.8 | 8.2 | 15.1 | 7 | 9.3 | 22.1 | 43 | | | 11.6 | 12.1 | 9.6 | 10 | 8.1 | 18 | 6.1 | 7.3 | 24 | 47 | | |

## IV. Variations in the Size and Shape of the Heart's Horisontal Orthoprojection in Pathological Conditions

In what follows I intend to analyse, in what manner changes in the different cardiac rooms are reflected on the horisontal orthoprojection.

The heart is located between the spinal column and the anterior wall of the thorax of which the former, at least, is almost unyielding in character. Formerly one used to speak more than now about a bulging or prominence of the precordia caused by an enlarged heart, and it seems to me possible that a growing heart might to some extent push the thoracic wall in front of it.

This displacement, however, is probably as a rule slight and after the oesophagus has been displaced side-ways, there is no more room into which the heart can expand in the direction of the spinal column, further enlargement having to take place sideways.

Fig. 9 represents the frontal and horisontal orthoprojection of the heart of a healthy individual with the horisontal thoracic circumferences marked out on level with the

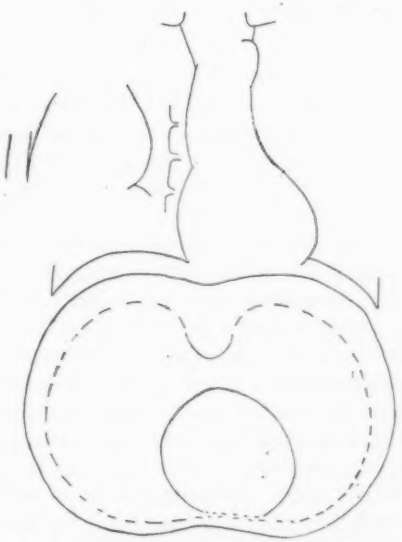


Fig. 9. Horisontal orthoprojection of the hear of a slim, young individual with his thoraci circumference mapped out, and frontal and lateral orthodiagrams of the heart of the same individual.

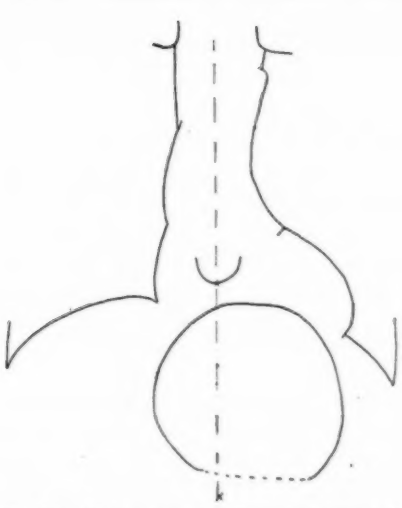


Fig. 10. The horisontal orthoprojection and the frontal orthodiagram of a heart in a case where the left ventricle was almost alone hypertrophied.

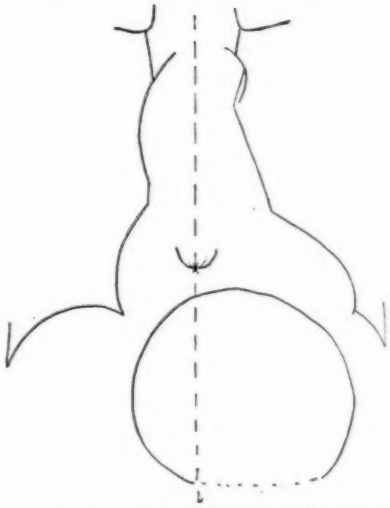


Fig. 11. Besides marked hypertrophy and probably also some dilatation of the left ventricle there is also here enlargement of the other cardiac rooms.

heart apex. It is evidently impossible to determine with certainty on the horisontal projection the boundaries between the different cardiac rooms but by comparing the picture with my anatomical reproductions of the heart it is nevertheless possible, as already stated, to state fairly reliably where the 4 cardiac rooms are located within the horisontal projection.

As already stated, the *left auricle* is fairly equally distributed over both sides of the mid-line and most cranially situated of the four rooms. The projection of this room will consequently be fairly axial and thus a slight enlargement of it will not appear so clearly on the horisontal projection. The spinal column does not permit of any greater backward displacement of the posterior wall and a greater enlargement will therefore be directed more towards the sides. This will become evident through flattening of the posterior part of the horisontal projection. In some cases, as that depicted in fig. 15, this cardiac room was so severely enlarged that the spinal column had formed a depression in its posterior wall, actually demonstrable by localising the anterior border of the spinal column on level with the auricle. This patient reacted very well to treatment, the blood accumulated in the heart diminished and the encroachment of the spine in the posterior wall of the heart could be seen to disappear.

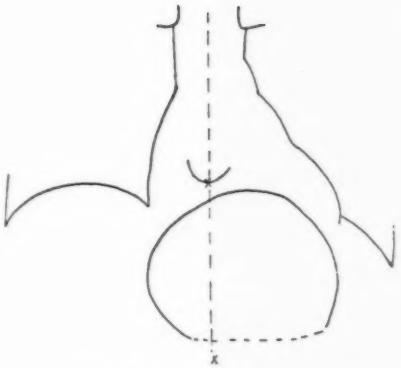


Fig. 12. Case of mitral stenosis with dilatation of the left auricle and right ventricle causing backward displacement of the apex.

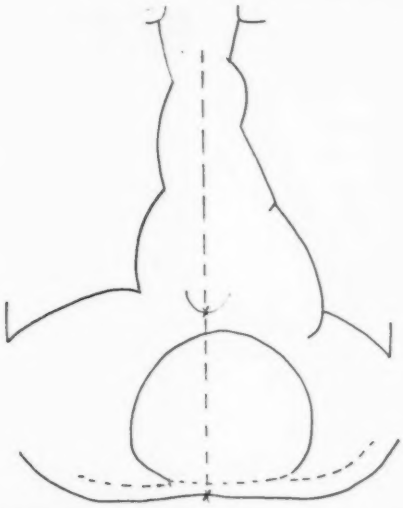


Fig. 13. Case of mitral incompetence with enlargement of the right ventricle besides also slight enlargement of the left ventricle.

The *left ventricle* is situated to the left and also backwards and an enlargement of this room is first made evident by the left portion of the horisontal projection becoming markedly rounded. In the case of this room also being dilated, the boundary will of course become more or less displaced towards the left, wherefore this powerful rounded shape will become less distinct. In cases where the left ventricle alone is hypertrophied or mostly so, that part of the heart lying close up against the thoracic wall is generally only slightly increased in width in relation to the whole horisontal diameter of the heart. The most obvious hypertrophy of the left ventricle is generally found in early cases of hypertonus; this view is also shared by LEWIS as a result of anatomical investigations. In more advanced cases of this condition, however, the hypertrophy is distributed more uniformly over all the four cardiac rooms and in some cases the right ventricle may be relatively more enlarged than the left. It seems to me, however, that this hypertrophy of the right ventricle must be ascribed to complications. Fig. 10, 11 show horisontal projections of hearts with more or less marked hypertrophy of the left ventricle.

On a frontal orthodiagram the *right ventricle* does not partake in the formation of the contour wherefore slight enlargement of this room only causes slight changes in its shape.

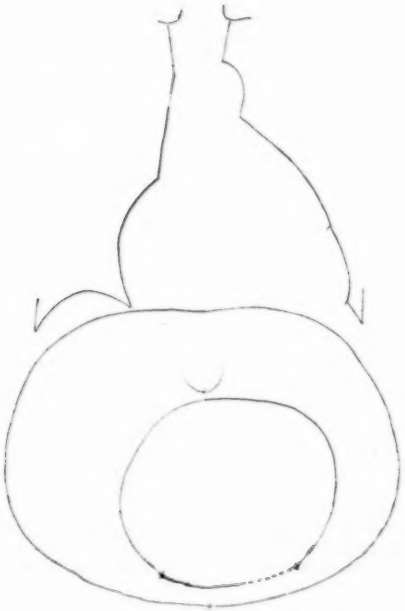


Fig. 14. Case of enlargement of all the cardiac rooms but with an uncommonly obvious dilatation of the right auricle. The primary valvular lesion in this case had been mitral stenosis.

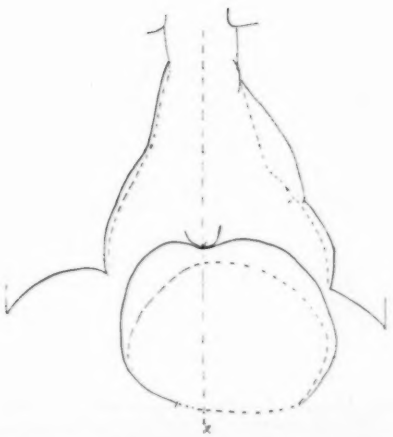
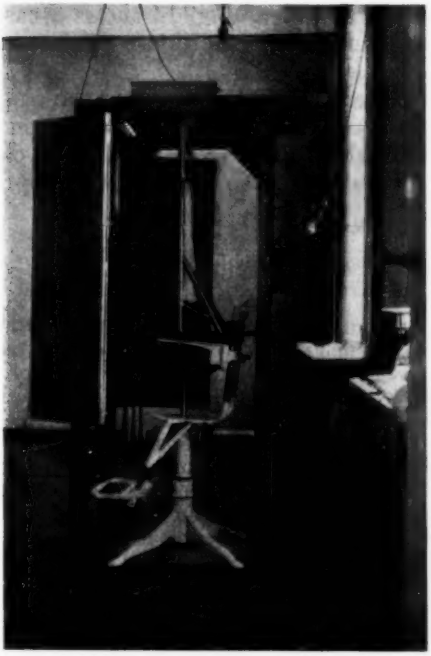


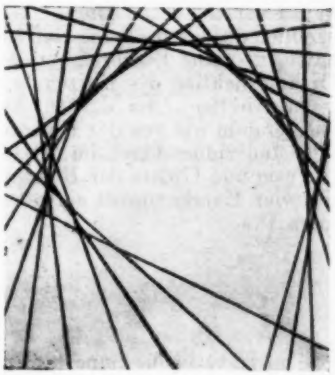
Fig. 15. Old affection of the mitral valve combined with an uncommonly marked dilatation of the left auricle. The dotted line shows the diminution of the heart after a period of treatment. It will be seen that the left auricle and the arteria pulmonalis in particular have diminished in size.

On the horisontal projection, on the other hand, it is easy to demonstrate an enlargement of the right ventricle. It is situated ventrally and an enlargement of it brings with it an increased breadth of that part of the heart lying close up against the anterior thoracic wall and at the same time the transition between the ventral part of the horisontal projection and its right and left lateral parts become sharper in outline than normally. Should not the left ventricle be simultaneously enlarged, as might be the case in pure cases of mitral stenosis, the heart apex may be found displaced backwards and also more pointed than normal. These changes as to shape, however, will be less obvious whenever the left ventricle is simultaneously enlarged. Fig. 12, 15.

Enlargement of the *right auricle* alone almost never occurs but is only found in advanced cases of asystolia.

Enlargement of this room becomes evident by an exaggerated rounded outline of the right part of the horisontal projection and by a right-





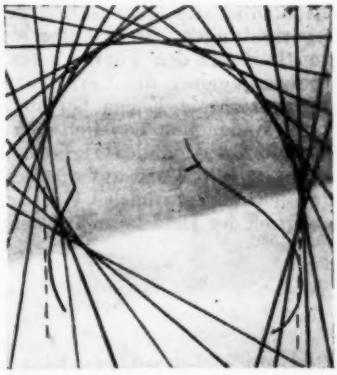


Fig. 16. The author's apparatus and the reconstruction of the horisontal orthoprojection of the heart.

sided displacement of its border. Fig. 14 shows a case with generalised enlargement of the heart but in addition a fairly considerable enlargement of the right auricle.

It will be clear, therefore, that changes in the shape and size of the heart are also in evidence on the horisontal projection and in some cases of slight alterations in shape of the ventricles these can be most readily and certainly demonstrated on the horisontal orthoprojection.

## SUMMARY

The paper is an abstract of a bigger work by the author and comprises 4 parts. The first part is a detailed anatomical account of the localisation of the cardiac rooms in different projections. The author is mainly basing his account on anatomical frozen sections through the thorax. In the second part the author describes his method for obtaining the orthoprojection of the heart on a horisontal plane in upright position. In the third part tables are submitted pertaining to the normal orthodiagram as also the horisontal orthoprojection of the heart of 150 healthy individuals and in the last part the author discusses the changes taking place in the shape and size of the horisontal orthoprojections on changes occurring in the size of the four cardiac rooms. The reader is referred as to details to the paper.

## ZUSAMMENFASSUNG

Der Aufsatz ist ein Referat über eine grössere Arbeit des Verfassers und enthält vier Abteilungen. Die erste gibt einen ausführlichen anatomischen Bericht über die Lokalisation der Herzkammern bei verschiedenen Durchleuchtungsrichtungen. Verf. stützt sich dabei hauptsächlich auf anatomische Gefrierschnitte durch den Thorax. Im zweiten Abschnitt wird eine Beschreibung der Methode gegeben, die Verf. anwendet, um die Orthoprojektion des Herzens auf eine horizontale Ebene bei stehender Stellung zu erhalten. Im dritten Abschnitt finden sich Tabellen vom normalen Orthodiagramm wie von der Horizontalorthoprojektion des Herzens bei 150 gesunden Individuen, und im letzten Abschnitt geht Verf. auf die Veränderungen der Form und Grösse der Horizontalprojektion ein, die bei Grössenveränderung der vier Herzkammern eintreten. Bezüglich der Details sei auf den Aufsatz verwiesen.

## RÉSUMÉ

L'étude ci-dessus constitue le compte rendu d'un travail plus important de l'auteur et comprend quatre chapitres. Le premier donne une description anatomique détaillée de la localisation des cavités cardiaques sous divers angles de diaphanoscopie. L'auteur s'appuie surtout sur des coupes congelées du thorax. Dans la seconde partie de l'ouvrage, l'auteur rend compte des méthodes aux-

quelles il recourt pour obtenir une orthoprojection du cœur sur un plan horizontal, en position orthostatique. Le troisième chapitre renferme des tableaux non seulement de l'orthodiagramme normal, mais aussi de l'orthoprojection horizontale du cœur chez 150 individus normaux; enfin, dans la quatrième partie de son travail, l'auteur donne les modifications survenant dans la forme et l'étendue de l'orthoprojection horizontale par suite de modifications dans les dimensions des quatre cavités cardiaques. Pour plus de détails, voir le travail lui-même.

FROM THE ROENTGENOLOGICAL DEPARTMENT, MARIA HOSPITAL, STOCKHOLM.
PHYSICIAN-IN-CHIEF: ÅKE ÅKERLUND, M. D.

# A CASE OF »GOLDEN HAIR»

by

*Folke Knutsson*

(Tabula V)

Only a sense of curiosity can justify the publishing of the following.

A 34 year old carpenter came to Maria Hospital on the 5th of Oct. 1929 for a fracture of the skull. On X-raying the skull we found a lot of shadows of metallic intensity, which were a few millimetres in length and resembled fine threads. We found that they belonged to the actual scalp and had nothing whatever to do with the bone. They were closely distributed all over the part where the hair grows, consequently there were none on the forehead or the face, so we understood that they must have something to do with the hair.

In spite of repeated questions the patient could not give any explanation as to this peculiar X-ray discovery, but we got an account of the real story from the patient's sister. He had been quite bald ever since he was 19 years old. In 1918 he was treated by a German »Professor» who inserted a lot of gold threads furnished with some hairs into the patient's scalp. This wig, however, lasted only for 6 months, after which time all the hairs were absolutely worn away and the patient was again as bald as before the treatment. Only the golden roots of the hair were left.

This cosmetic operation cost him 1,000 Swedish crowns and consisted of 2,000 tufts of hair.

## SUMMARY

The author describes a curious case, an absolutely bald-headed man with 2,000 small gold threads in his scalp. When the threads were first put in they were furnished with tufts of hair, which, however, after 6 months were quite worn away.

Fig. 1.

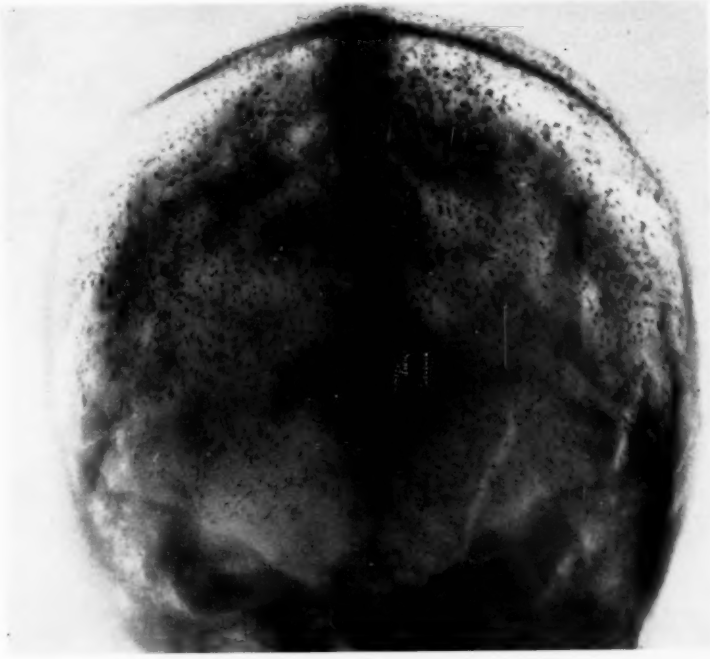


Fig. 2.

## ZUSAMMENFASSUNG

Verf. beschreibt einen merkwürdigen Fall von einem absolut glatzköpfigen Mann mit 2,000 dünnen Goldfäden in der Kopfhaut. Als die Fäden ursprünglich eingesetzt wurden, waren sie mit Haarbüscheln versehen gewesen, die aber nach Ablauf von 6 Monaten gänzlich verschwunden waren.

## RÉSUMÉ

L'auteur décrit le cas curieux d'un homme absolument chauve qui présentait dans le cuir chevelu 2,000 fils d'or extrêmement minces. Lorsque ces fils avaient été posés, ils étaient munis de touffes de cheveux qui cependant, au bout de 6 mois, avaient complètement disparu.

FROM THE X-RAY INSTITUTE OF THE MUNICIPAL HOSPITAL, AARHUS, DENMARK
(CHIEF: CARL KREBS, M. D.)

# ISOLATED ASEPTIC NECROSIS IN THE EPIPHYSIS OF THE FIRST METATARSAL BONE

by

*Aage Wagner*

Senior Assistant Roentgenologist

(Tabula VI)

As greater attention has gradually been given to the so-called aseptic necroses in epiphyseal and apophyseal bones, it has been found that those affections are by no means uncommon. With regard to several bones, degenerative changes of this character have been known for many years, and new observations, with regard to others, are constantly being added.

Among the first described are the SCHLATTER-OSGOOD disease of the tibial tuberosity; PREISER's, of the navicular bone of the hand; KIENBOECK's, of the lunate bone; and the CALVÉ-LEGG-PERTHES disease of the head of the femur. Later, similar affections have been found in the navicular bone of the foot (KOEHLER), in the head of the second and third metatarsal bones (KOEHLER, PANNER), in the vertebral column (SCHEUERMANN's disease, CALVÉ's vertebra plana) and in the patella (SINDING-LARSEN, JOHANNSEN). Perhaps KUEMMELL's disease may be considered as belonging to the same group. If so, it would be the earliest one recognised, as it was described already in 1891. All the affections here enumerated are by now well known; but besides, there have from time to time been described sporadic cases of similar changes in many other bones; as in the sesamoid (JAROSCHY, MUELLER), the third cuneiform and the head of the fifth metatarsal (K. WAGNER), the neck of the astragalus (AXHAUSEN, DEUTSCHLÄNDER), the cuboid bone (LANCE, SILFVERSKJÖLD), the os Vesaleanum and calcaneus (SNELLMAN), the intercondyloid eminence of the tibia (DEUTSCHLÄNDER, K. WAGNER), the outer condyle of the femur (ROSENTAL, GINSLING, K. WAGNER), the inner condyle of the femur (SEKIGUSHI, SHIGEKI, SHIRO RYU), the

sternal extremity of the clavicle (WEISZ), the capitulum humeri (ISELIN, PANNER, KREBS), the epiphyses of the phalanges of the fingers (FLEISCHNER, KLOIBER), the heads of the metacarpal bones (MAUCLAIRE), the radius (BLOCK). Of the last-named it is true that the disease was located in the metaphysis, but BLOCK nevertheless thinks that, both from the clinical and the radiological findings, the case belongs to exactly the same group as the other affections here mentioned. Besides these, there are cases described of symmetrical, consecutive and systematised occurrence of epiphyseal necroses (FLEISCHNER, FLEMMING MØLLER, BRANDES, CHRISTOFFERSEN, MATHEZ, THIEMANN and others).

The case which we have had occasion to examine in the Roentgen Clinic of the Aarhus Municipal Hospital seems to me to constitute a new link in this chain. At least, I have not been able, in the whole of the rather abundant literature to which I have had access, to find another case of this isolated localisation to the base of the first metatarsal bone. The history of the case is as follows:

Patient, a girl six years old; parents healthy. At the age of four she had the measles and chicken-pox; otherwise she has always been in good health. A year ago she fractured the radius of her left arm by falling, in jumping from a boulder 1 meter high. This fracture has since healed in good position, within normal time, and can by now not be demonstrated in any way. At that time she did not complain of any pain in her foot, nor of any trouble in walking. Two months ago she began to complain about not being able to walk as fast as formerly, and explained that when she became tired of walking she got a slight pain in the left foot, at a point corresponding to the medial portion of the first tarsometatarsal articulation. As the symptoms would not cease, she was directed to the roentgen clinic, with the diagnosis: *obs. for Mb.* KOEHLER *I sin.*

The result of our objective examination was as follows: The patient's appearance is one of natural good health; her degree of intelligence and development correspond with her age. Growth of hair, abundant; cranium, normal; oral cavity and teeth likewise. No indication of former rickets. Skin, moist. No peripheral adenitis. Thyreoid gland, normal. *Stethoscopy:* Heart and lungs normal. Abdomen likewise.

The extremities appear normal, too, with exception of the feet. In the left foot there is a slight but unmistakable swelling extending over an area corresponding with the joint between the tarsus and the first metatarsal bone and immediate surroundings. This swelling is distinctly seen in the adjoined side-view of the foot. It is quite firm, there is neither edema nor vein tracings, but the skin is of a faint pale-reddish tint. The joint is distinctly tender, both directly and indirectly, but not markedly so. It takes a rather strong pressure to make it felt. A similar pressure on the corresponding point of the right foot caused no pain. The mobility of all the joints is free and complete, without any difficulty or pain. The walk, on examination, is natural.

There is no measurable atrophy of the foot or of the muscles of the leg. The muscular tonicity is alike on both sides. On both feet, the hallux is the longest of the toes (see the roentgenograms). The patient generally uses shoes with leather soles and low heels.

The arches of both feet are rather low, but imprints of them showed that the patient is not flat-footed. As the ligaments were very much relaxed it was thought, however, that the case might be one of incipient *pes planus*. Pirquet's reaction was positive, Wassermann negative; basal metabolism, 106 per cent. The patient's height was 112 cm; weight, 42 pounds.

We thus have here a patient in the growing age, having pains in the left foot, in the region of the first tarsometatarsal articulation, with surrounding slight tumefaction, redness of the skin and tenderness of the joint; and with, possibly, a one year old trauma in the anamnesis.

Roentgen examination (Figs 1 to 3) showed the epiphysis in the proximal end of the first metatarsal bone of the left foot to be considerably broader, from side to side, than the corresponding bone in the right foot, and smaller proximo-distally. The osseous structure was consolidated, except in two places where there were a couple of slight rarefactions. The demarcation toward the tibial side was not very sharp, rather »woolly». The interarticular space was about 1 mm. wider than the corresponding one in the right foot. In the side view, especially, it is seen very clearly how, in the right foot, there is a distinct double contour of the epiphysis, while, in the left foot, this double contour has almost disappeared, and there remains only like a thin, compact shell. None of the other bones of the foot show any abnormal features.

The clinical and roentgenological findings leave hardly any doubt about our being in the presence, here, of an affection of exactly the same character as the malacopathias mentioned in the beginning of this paper. I examined the patient two, four and six months later, and the roentgen pictures were entirely the same. So was the tumefaction of the left foot; but the subjective symptoms had disappeared after the patient had been given arch supporters in her shoes, and had been cautioned to avoid tiring her feet. Roentgen examination showed the other epiphyses, both of her legs and arms, to be entirely normal.

Aseptic necroses of the epiphyses are undoubtedly not always due to the same cause. From the very beginning, the trauma — either a single, violent, or repeated slighter ones — was held to be the principal etiologic factor.

Already PREISER maintained that the origin of the affection in the navicular bone of the hand, described by him, must be sought in a traumatic disturbance of the vascular supply to that bone; an opinion concurred in by KIENBOECK with regard to the malacia of the lunate bone. Their idea was that the supposed lesion of the vessels gave rise to a rarefying inflammatory process in the bone, with subsequent degeneration — eventually, perhaps, conditioned upon succeeding, very slight traumata. LEGG and PERTHES maintained the same with regard to the

affection in the hip; and quite recently PANNER has strongly asserted the etiologic significance of the trauma with regard to the affection, described by him and KOEHLER, of the second metatarsal bone. In AXHAUSEN's opinion, the explanation is to be found in the occlusion — thrombotic or embolic — of the afferent vessels. Others again — SANTOZKI and KOPELMANN, for instance — think that repeated slight traumata give rise to an obliterative endarteritis, which gradually leads to necrosis of the bone. Later, when collateral circulation has been established, the degenerated osseous tissue should then become resorbed; and, later again, the remainder would collapse and become sclerotic.

FABRICIUS-MØLLER, in his work on Malacia of the lunate bone, maintains that that affection, in the majority of cases, at least, primarily is a fracture. It is possible that the affections described by KIENBOECK, KUEMMELL and PREISER belong to an entirely different group from the other aseptic bone necroses mentioned, and that also their etiology is different. They occur in adults, and the prognosis *quoad functionem* is bad; while the others occur in children or in individuals still in the growing age, and their prognosis is much more favorable.

BENTZON has given an entirely new explanation as regards the importance of the trauma. In the first place, he has shown — by means of anatomical and roentgenological examinations of bones of children — that those epiphyses which most frequently become the seat of an aseptic necrosis are supplied by arteries that lie along, or through, the epiphyseal lines, and must therefore be supposed to be particularly exposed to traumatic influences. In the second place, he has shown that it is possible to produce experimentally, in animals, not only affections exactly similar to the aseptic necroses of the epiphyses, but also changes in the diaphyses seemingly identical with OLLIER's disease, by removing or destroying the sympathetic nerves. He therefore believes that those affections may be due to the same cause; namely, to a fluxionary hyperemia induced by the traumatic lesion to the sympathetic nerve; though he is careful to add that also other causes — or, possibly, a combination of such — may be imagined. KLOIBER, FLEISCHNER and SNELLMAN think that insufficient nutriment may be an etiologic factor.

FLEMMING MØLLER has set up a theory of hypothyrea as the cause of Calvé-Legg-Perthes' and a number of allied diseases. He bases the idea partly on his own investigations of the metabolism in a number of patients with those affections, partly on roentgen examinations — by himself, CHRISTOFFERSEN, KRABBE and others — of the bone centers in pronounced cretins. The further fact that, in a long series of cases, he has noted a favorable effect of thyreoidin in those affections — both where only a single epiphysis was involved and where the affection manifested itself as a systemic disease — might very well indicate that

hypothyrea *can* be the cause; but, on the other hand, several of the observations made by the other authors I have named in the foregoing make it highly probable that also other causes can produce the changes in the bones here spoken of.

How the affection occurred in my patient is difficult to say. That it should be due either to hypothyrea or to insufficient nourishment I think may be considered as out of the question. The girl is to all appearances perfectly normally developed, both physically and mentally; she comes from a well-situated home, is in a well-nourished condition, rather strongly developed, and her basal metabolism is not lowered. I am more inclined to believe in a traumatic origin of her case. A primary fracture is not to be supposed. It is true that a year ago she sustained a fall in jumping down from a height of 1 meter; but she did not at that time get any pain in her foot. Rather should I believe that she may, from time to time, have become the subject of several minor traumata. PANNER, in the work to which I have already alluded, says, about the corresponding affection in the capitulum of the second metatarsal bone, that its frequent occurrence in that particular place is perhaps due to the fact that the second toe is the one most exposed to slight traumata, on account of it being the longest. Now, in my case the first toe is the longest, and it seems to me that I might therefore perhaps appropriate his reasoning to fit also the present instance. Besides, there is, as we have seen, an incipient longitudinal flat-footedness; and it is perhaps not unlikely that, in the course of the development of the latter, a particularly strong pressure may come to lie on the medial bones of the metatarsus, and that this may have contributed to the development of the affection.

## SUMMARY

The author — after briefly reviewing what has hitherto been published on the subject of the so-called aseptic, epiphyseal and apophyseal necroses — communicates a case of an affection of similar, but not hitherto described character, in a girl 6 years old. In conclusion, he dwells on the possible causes of these affections in general, and the one observed by him in particular.

## ZUSAMMENFASSUNG

Nach einem kurzen Referat der bisherigen Publikationen über das Thema der sogenannten aseptischen, epiphysealen und apohysealen Nekrosen berichtet Verf. über einen Fall einer bisher nicht beschriebenen Affektion von ähnlichem Charakter bei einem 6jährigen Mädchen. Zum Schlusse bespricht er die möglichen Ursachen dieser Affektionen im allgemeinen und des von ihm beobachteten Falles im besonderen.

Fig. 1.

Fig. 2. Left foot.

Fig. 3. Right foot.

## RÉSUMÉ

Après une brève énumération des cas antérieurement publiés de nécroses épiphysaires et apophysaires dites aseptiques, l'auteur communique un cas personnel d'affection analogue, mais d'un caractère non décrit jusqu'ici, chez une fillette de 6 ans. Comme conclusion, il s'arrête plus particulièrement à l'étiologie possible de l'affection en général et notamment du cas qu'il a eu l'occasion d'observer.

## LITERATURE

ABRAHAMSEN, H.: Köhlers Sygdom i Os naviculare pedis med særlig Henblik paa dens Pathogenese. Hospitalstidende, 1927, p. 87.

AXHAUSEN, G.: Ueber anämische Infarcte des Knochensystems und ihre Bedeutung für die Lehre von den primären Epiphysenekrosen. Archiv f. Klin. Chir., 1928, p. 72.

—, Zum Vorkommen des Abgrenzungsvorganges am Fussgelenk. Centralbll. f. Chir., 1928, p. 322.

BENTZON, P. G. K.: Roentgenological and experimental studies on the pathogenesis of the dyschondroplasia. Acta Rad., Vol. III, 1924, p. 89.

—, Experimental studies on the pathogenesis of Coxa plana and other manifestations of dyschondroplasia. Ibidem, Vol. IV, 1926, p. 155.

—, Roentgenological investigations concerning in the arterial supply of the epiphysis. Ibidem, Vol. VIII, 1927, p. 618.

BERGMANN, E.: Theoretisches, klinisches und experimentelles zur Frage der aseptischen Knochennekrosen. Deutsche Zeitschr. f. Chir., 1927, p. 1.

BLOCK, W.: Traumatische aseptische Metaphysenekrose des Radius und ihre Beziehung zu anderen gelenknahen Knochenerkrankungen. Archiv f. klin. Chir. Bd. 142, 1926, p. 626.

BRANDES, M.: Das Krankheitsbild der Osteochondritis deformans juvenilis. Med. Klinik. No. 28, 1914, p. 1176.

—, Experimentelle Untersuchungen über den zeitlichen Eintritt der durch Inaktivität bedingten Knochenatrophie. Fortschr. a. d. Geb. d. Röntgenstr., Bd. 21, 1914, p. 551.

CALVÉ: Sur une forme particulière de pseudocoxalgie. Rev. de Chir., Vol. 42, 1910.

CHRISTENSEN, L.: Et Tilfælde af Kienböcks Sygdom. Hospitalstidende, 1924—25, p. 107.

CHRISTOFFERSEN, N. R.: Stofskifte og indre Sekretion. Ugeskr. f. Læger, 1920, p. 838 og 879.

DEUTSCHLÄNDER, C.: Zur Kenntnis der gelenknahen Nekrosenherde im subchondralen Knochenraum. Centralbll. f. Chir., 1928, p. 469.

FABRICIUS-MØLLER, F.: Den subcutane isolerede Fractur af Os lunatum. Bibl. f. Læger. 1919, p. 137.

FLEISCHNER, F.: Multiple Epiphysestörungen an den Händen. Fortschr. a. d. Geb. d. Röntgenstr. Bd. 31, 1923—24, p. 206.

—, Gehört die Patella bipartita zum Kreis der Osteochondropathia juvenilis? Ibidem, Bd. 31, 1923—24, p. 209.

FLEMMING-MØLLER, P.: Malum deformans coxae infantile. København 1924 (Disp.)
—, A case of Köhler's disease in the navicular bone of the foot followed from its earliest stage until complete restitution. Acta Rad., Vol. VIII, 1927, p. 620.
FRIIS, I.: Fractura Tuberositatis tibiae. Hospitalstidende, 1898, p. 485.
ISELIN: Cit. e. Panner, H. J.: An affection of the capitulum humeri ..... Acta Rad., Vol. VIII, 1927, p. 617.
JAROSCHY, W.: Die sogenannte Malazie des Os lunatum carpi und ihre Beziehungen zu anderen lokalisierten Skelettkrankheiten. Brun's Beiträge zur klin. Chir., 1928, p. 75.
KIENBÖCK, R.: Ueber traumatische Malazie des Mondbeins und ihre Folgezustände: Entartungsforme und Kompressionsfracturen. Fortschr. a. d. Geb. d. Röntgenstr. Bd. 16, 1910—11, p. 77.
—, Ueber Luxationen im Bereiche der Handwurzel. Ibidem, Bd. 16, 1910—11, p. 103.
KLOIBER, H.: Symmetrische Epiphysenerkrankung der Hände. Ibidem, Bd 31, 1923—24, p. 206.
KREBS, C.: Maladie de Panner, une affection du condyle de l'humerus ressemblant à la maladie de Calvé-Perthes. Archives Franco-Belges de Chirurgie, No. 7, 1927.
—, Diskussionsindlæg til Panner, H. J.: An affection of the capitulum humeri resembling Calvé-Perthes' disease of the hip. Acta radiologica, Vol. VIII, 1927, p. 618.
KÜMMELL, H.: Die posttraumatische Wirbelerkrankung. (Kümmell'sche Krankheit.) Archiv f. klin. Chir., Bd. 128, 1921, p. 876.
LANCE: Ostéochondrite de Cuboïde chez un enfant porteur de chondrite costale. Presse médicale, 1926, p. 681.
LEGG, A.: An obscure affection of the hip-joint. Boston med. an. surg. Journal. 1910.
MATHEZ, J. A.: Beitrag zum Studium der Apophysitis, der Osteomalazie der männlichen Erwachsenen und der Kokzykodynie. Fortschr. a. d. Geb. d. Röntgenstr. Bd. 29, 1929, p. 528.
MAUCLAIRE, P.: Epiphysitis der Metacarpusköpfchen mit Hohlbildung der Hand. Ibidem, Bd. 37, 1928, p. 425.
OSGOOD, R.: Lesions of the tibia tubercle occurring during adolescence. Boston med. an. surg. Journal. 1903.
PANNER, H. J.: A peculiar characteristic metatarsal disease. Acta Rad., Vol. I, 1922, p. 319.
—, An affection of the capitulum humeri resembling Calvé-Perthes' disease of the hip. Ibidem, Vol. VIII, 1927, p. 617.
—, En ejemdommelig om Calvé-Perthes' Hoftelidelse mindende Sygdom i Capitulum humeri. Ugeskr. f. Læger. 1930, p. 1.
PERTHES, G.: Ueber Artroitis deformans juvenilis. Deutsche Zeitschr. f. Chir. Bd. 107, 1910, p. 111.
PREISER, G.: Eine typische posttraumatische und zur Spontanfractur führende Ostitis des Naviculare carpi. Fortschr. a. d. Geb. d. Roentgenstr. Bd. 15, 1910, p. 189.
—, Zur Frage der typischen traumatischen Ernährungsstörungen der kurzen Hand- und Fusswurzelknochen. Ibidem, Bd. 17, 1911, p. 360.
ROSENTAL, T. & GINSLING, W.: Osteochondritis juveniis deformans Condyli ext. femoris. Centralbll. f. d. ges. Radiologie. Bd. 1, 1926, p. 613.

SANTOZKI, M. & KOPELMANN, S.: Ein Beitrag zur sogenannten Malacia ossis lunati & navicularis. Fortschr. a. d. Geb. d. Roentgenstr. Bd. 39, 1926, p. 1060.
SCHEUERMANN, H.: Kyfosis dorsalis juvenilis. Ugeskr. f. Læger. 1920, p. 385.
SCHLATTER, C.: Unvollständige Abrissfracturen der Tuberositas tibiae oder Wachstumsanomalien? Bruns Beitr. zur klin. Chir. Bd. 59, 1908, p. 518.
—, Verletzungen des schnabelförmigen Fortsatzes der oberen Tibiaepiphyse. Ibidem, Bd. 38, 1903, p. 874.
SEKIGUCHI, SHIGEKI & SHIRO RYU: Ueber Epicondylopathia femoris medialis. Mitt. über allgemeine Path. & path. Anat. Bd. 3, 1926, p. 317.
SILFVERSKJÖLD, N.: Ein Fall von posttraumatischer Nekrose in Calcaneus und Cuboideum mit an die »lokale Malazie» erinnernden Veränderungen. Acta Rad., Vol. VII, 1926, p. 473.
SINDING-LARSEN: A hitherto unknown affection of the patella in children. Acta Rad., Vol. I, 1922, p. 171.
SNELLMAN, Aa.: Ueber eine Epiphysenerkrankung des jugendlichen Alters. Centralbll. f. d. ges. Radiologie, Bd. 4, 1928, p. 675.
THERSTAPPEN: Ueber traumatische Malazie d. os. nav. & lunati. Festschrift z. Feier des zehnjährigen Bestehens der Akademie für praktische Medicin in Cöln. Cöln, 1915.
THIEMANN, H.: Juvenile Epiphysestörungen. Fortschr. a. d. Geb. d. Röntgenstr. Bd. 14, 1909—10, p. 79.
WAGNER, K.: Bekannte und unbekannte Malakopathien. Med. Klinik. 1928, p. 1349.
WEISZ, A.: Ueber einige juvenilen Knochenkrankheiten. Centralbll. f. d. ges. Radiologie. Bd. 1, 1926, p. 401.

# PROCEEDINGS

OF THE

# NORTHERN ASSOCIATION OF MEDICAL RADIOLOGY

(— NORDISK FORENING FOR MEDICINSK RADIOLOGI —)

## AN ACCOUNT OF THE SIXTH CONGRESS OF THE ASSOCIATION

HELD IN THE AUDITORIUM OF THE PHYSIOLOGICAL INSTITUTE OF THE UNIVERSITY OF OSLO

JUNE 25th to JUNE 27th, 1929.

Edited by

*Chr. I. Baastrup, Secretary-General*

---

### LIST OF OFFICERS.

*President:* Dr. S. A. HEYERDAHL.
*Honorary Presidents:* Dr. L. EDLING, Prof. GÖSTA FORSSELL, Dr. H. J. PANNER.
*Secretary-General:* Dr. CHR. I. BAASTRUP.
*Secretaries:* Dr. T. DALE, Dr. P. FLEMMING MØLLER, Dr N. WESTERMARK.

---

# Minutes of the Sixth Ordinary Meeting of the Northern Association of Medical Radiology,

held in the Physiological Institute of the University of Oslo, June 25th, 1929.

1. The President, Dr. HEYERDAHL, opened the meeting and, after welcoming all those present, spoke in memory of Dr. ROBERT KNOX, honorary member of the N. A. M. R. and Dr. BRODERSEN, of Drammen, member of the Association, deceased since the meeting of the last Congress.

2. The Protocol of the last meeting was read and approved.

3. *Resolved*, that Dr. L. EDLING (Sweden), Prof. GÖSTA FORSSELL (Sweden) and Dr. H. J. PANNER (Denmark) be elected Honorary Presidents of the Congress of 1929; that Dr. CHR. I. BAASTRUP be elected Secretary-General, and Dr. T. DALE (Norway), P. FLEMMING MØLLER (Denmark) and Dr. NILS WESTERMARK (Sweden) Secretaries of the Congress.

4. *Resolved*, that *forty-five* minutes be allowed for each of the opening papers to be read at the Congress, *thirty* minutes for each of the other papers, and *ten* minutes to each speaker taking part in the discussions.

5. *Resolved*, that the special fee for attending the Congress shall be in the sum of 10 (ten) kroner.

6. *Resolved*, that a full report of the Transactions of the Congress shall be published in the *Acta Radiologica*.

7. *Resolved*, that the Presidents of the Radiological Societies in Denmark, Finland, Norway and Sweden be requested to designate and make arrangements for Members of their respective Societies to present opening papers at the next Congress, and to chose subjects for same.

8. *Resolved*, that the next meeting shall be held in 1932, either in Reykjavik (Island) or in Lund (Sweden), from both of which places invitations have been received; and that Dr. HEYERDAHL and Dr. BAASTRUP be charged with the preliminaries necessary for the final decision. And further, that, in case Reykjavik is chosen, Dr. CLAESSEN shall be President; in case Lund is chosen Dr. EDLING.

9. *Resolved*, that Dr. BAASTRUP be requested to continue to act as Secretary-General until 1932.

All resolutions adopted as above.

CHR. I. BAASTRUP, Sec'y-Gen.

# Scientific Transactions

## I. Gösta Forssell: The Organisation of the Jubilee Foundation's Cancer Campaign in Sweden.[1]

### Discussion:

I. H. J. Panner, Copenhagen: I think I may express to Prof. Forssell our heartiest thanks for the discourse to which we have just had the privilege of listening; a discourse not only weighty and thought-compelling in itself, but thoroughly illuminated by the warmly humane sentiment of the speaker. We, in this audience, probably all agree with his views concerning these questions; therefore, I venture to suggest that this is not the forum before which his discourse ought to have been delivered. Its aim and address has direction toward an auditory much larger than the one here present, and I believe that it should be published in a manner that would bring it to the notice, as far as possible, of all Scandinavian physicians, in order that they may become acquainted with the views of an absolute authority on these matters just at the present time, when measures are being prepared, in the different Scandinavian countries, with a view to an efficient fight against cancer.

I would therefore suggest to the Council of this Association that they take steps to have this paper of Prof. Forssell's published in the leading medical journals of the Scandinavian countries, so as to give the largest possible number of medical readers the opportunity of becoming acquainted with it.

II. Edvard Collin, Copenhagen: I, also, desire to thank Prof. Forssell for his weighty discourse. My only regret is that it was not delivered before an audience of surgeons or hospital physicians, that there might have been an opportunity of hearing the views of others; we radiologists being, of course, more or less of one mind on the subject. About a year ago, a circular letter was sent to all the hospital physicians in Denmark, asking them to state their views concerning a centralisation of the cancer therapy. Opinion proved to be overwhelmingly against centralisation. It is thus among the surgeons that the discussion ought to be raised. Personally, I am of the opinion that a centralisation of certain forms of cancer, adapted to the requirements of each country, would be the most advisable.

III. Gösta Forssell, Stockholm: I thank Dr. Panner and Dr. Collin for their kind words of appreciation. I shall gladly place my paper at the dis-

[1] Will be published in extenso in the Acta Radiologica.

posal of the Council for publication in the Scandinavian medical journals in such manner as they may deem most suitable. It will be published in English in the Acta Radiologica. The report of the Jubilee Committee, embodying the proposition for organisation of the cancer campaign in Sweden, has been handed, in English translation, to the British committee collecting funds for the cancer campaign; a German translation of the same report is at present being made at the expense of the German cancer committee.

IV. S. A. HEYERDAHL, Oslo: I, too, wish to thank Prof. FORSSELL for the most interesting manner in which he has traced for us the lines that are to govern the cancer campaign in Sweden. We must agree with him that the main thing is to organise the fight against cancer in such a manner that the treatment of that disease is concentrated in a few large centers under the direction of trained specialists and amply provided with radium and the best of roentgen apparatus. The work of cancer research, as well, must be fully provided for in those central institutions.

The principle maintained by FORSSELL is to a large degree the same that has been carried through in France, where all treatment of cancer is concentrated in the large medical institutions, the whole country being divided into regions, each having its own center for cancer treatment, with surgical and radiological specialists attached and amply supplied both with radium and roentgen equipment.

This Swedish plan for organisation of the fight against cancer ought certainly to be made more widely known. Authorities, cancer societies and others in the Scandinavian countries, who are interested in these matters, should be made acquainted with it. I am sure that it will be of immense value to those other countries in their work of systematising the fight against cancer there.

In conclusion, let me say that, beside organisation of the treatment, the work of popular enlightenment must be assiduously undertaken, in order that the patients may come in for treatment at the earliest possible stage of the disease. The great value of such a work of enlightenment has been amply proved in the United States.

V. GÖSTA FORSSELL: To Dr. HEYERDAHL's remarks I would like to say that he is right in stating that also in France the necessity has been realised of centralising the fight against cancer in order to make it effective, as proved by the establishment of centers for cancer treatment in various parts of that country. But we do not find there — as in the Swedish plan — the radiological treatment firmly organised and centred in hospitals specially adapted for the purpose, and with the whole of the radiological as well as the combined surgical and radiological treatment under one single line of direction. The importance of such an organisation has, however, been eloquently set forth by CL. REGAUD.

## II. S. A. Heyerdahl: The Norwegian Radium Hospital

In the fall of 1916, an appeal to the public was issued by a number of Oslo physicians, for funds with which to establish a National Hospital for the Treatment of Cancer by Radium and Roentgen.

By the end of December 1929, thanks to private subscriptions and a considerable contribution from the State, the Cancer Fund had reached the sum of

somewhat over 2,800,000 Crowns, therein included the value of a hospital site and radium purchased.

The hospital — the name of which is to be: The Norwegian Radium Hospital — is at present in the course of construction. The corner stone was laid the 15th of June, 1929. By January 1st, 1931, it is hoped that the building containing the wards will stand completed, fully equipped and ready for use.

The Norwegian Radium Hospital is a self-governing institution dedicated to the treatment of cancer and allied diseases, particularly inoperable cases, combined with research work and the study of preventive measures against them.

The hospital is being built to accommodate 50 beds and a policlinic, but is built in such a manner that it can without difficulty be enlarged, if so needed later on. It will have a surgical service, and will be equipped as completely as possible, both with radium and with roentgen apparatus. There will be a laboratory for pathoanatomical and other examinations, as well as for cancer research.

There will be a »Dep't of Records and Control», the task of which will be to keep track of the patients after they leave the hospital, to keep records and statistics of the results of the treatment, to correspond with patients and with the physicians at whose direction they were sent us, to summon patients for any necessary renewal of treatment, etc. etc.

To arrange the organisation of the hospital, a committee has been appointed. Its work is not yet concluded.

*The speaker thereupon showed the plans of the hospital, which, including the roentgen apparatus — but not the radium — will cost about 1,500,000 Crowns.*

**Discussion:**

I. GÖSTA FORSSELL: We must all congratulate Dr. HEYERDAHL to the successful accomplishment of the great object so near to his heart: the creation of this Norwegian hospital for the treatment of cancer by radium and roentgen. There can be no doubt but that this institution is destined to play an important part in the development of radiotherapy in Norway.

When I look at the plans in the light of our experiences from the Radiumhemmet in Stockholm, it occurs to me whether it would not be the most practical to place those laboratories which are to deal principally with the radium treatment in close proximity to the wards rather than to the policlinic, seeing that it is the in-patients, of course, who will principally be the subjects for that treatment. I wonder if it would not be best to place even the experimental laboratories apart from the policlinic, and to make the department for roentgen therapy into one separate unit. From our experience in Stockholm I would say that also the reception-, office- and filing departments ought possibly to be larger; but all that will, of course, be best found out by experience.

II. S. A. HEYERDAHL: To Prof. FORSSELL's remark that the physical laboratory ought to be placed in another building than the one where the radium is stored, I wish to say that it has been thought sufficient if the radium was stored in the basement and the laboratory installed in the attic; but that the possibility of having to build a separate laboratory building, isolated from the main building, has already been thought of, in case the present arrangement should be found not to offer sufficient security for the physical instruments. As to the risk of the space allotted to the policlinic proving too small, I would say that there is plenty of room for enlargement in case it should be found necessary.

III. LARS EDLING, Lund: May I ask Prof. HEYERDAHL, where this hospital is going to be situated; because it is, of course, of the greatest importance that it should not be situated too far from Oslo with its good communications and easy access to scientific institutions.

## III. Edv. Collin, Copenhagen: The Treatment of Lip Cancer, especially as regards the Metastases

(From the Radium Centre, Copenhagen.)

Tumor of the lip is one of the forms of cancer in which the clinical features lend themselves most easily to study, and in which the metastases can be discovered the earliest. The result of surgical treatment in such cases shows about 45 per cent of healings; of radiological treatment, about 60 per cent. — results which it seems might be still further improved upon. From the Radium Centre of Copenhagen, the speaker presents a material of 131 cases, 80 of which have been under observation for more than three years. The treatment of the lip tumors has been by radium, in the form of cross-fire contact radiation with massive doses of from 50 to 250 milligrams of radium element; in a few cases, by the way of trial, radium implantation or distant treatment instead. The regional lymph nodes were treated by roentgen. The technic is dwelt on; and the advantages of using »soft» rays, rather than hard ones, are pointed out. The result is 64 (= 80 %) cases healed, of the 80 that had been under observation for more than three years; and in those are included all the severest ones. The 20 per cent. that either died or became worse had all been previously treated elsewhere, either surgically or with roentgen; except two, who had been treated by radium implantation.

The speaker dwells particularly on the treatment of metastases; because it is found that in prophylactic roentgen treatment of the regional lymph nodes the result, when hard rays are used, is not only decidedly poorer than with soft rays — glandular recurrences being frequent — but is poorer, even, than after no roentgen treatment of the nodes at all. The difficulty of determining the true character of the nodes — whether metastases or infection — is discussed. In three cases, however, in which the nodes were extirpated, they proved to be cancerous.

The conclusion is that the best results are obtained by treating the lip tumor with radium (contact treatment), and the regional lymph nodes with roentgen (soft rays).

### Discussion:

I. A. S. HEYERDAHL: When Dr. COLLIN tells us that he has succeeded in making cancerous glandular metastases disappear by means of roentgen, I confess to being rather sceptical about such a statement. I have never myself, as far as I remember, in one single instance been able to cure a case of such metastasis by roentgen, either by using soft or hard rays. It would also be difficult to prove that such a thing has actually been done. According to REGAUD, only 20 per cent. of swollen lymph nodes in connexion with lip tumor are of a cancerous nature; the rest are infectious. With the naked eye it is impossible to determine with any degree of certainty whether a lymph node is the one or the other. Very hard nodes are sometimes under the microscope found to be infectious. Cancerous glandular metastases can sometimes be made to disappear by distant radium treatment.

II. LARS EDLING: I must congratulate Dr. COLLIN to the good results he has obtained by local contact treatment of lip cancer with radium. On the whole, I think they agree with what has been our experience in Sweden. With regard to the glandular metastases, on the other hand, our results in Lund have been so remarkably inferior to his, that I really must share the doubt expressed by Dr. HEYERDAHL, about the cancerous nature of the lymph nodes in the cases treated by Dr. COLLIN. It must be remembered that many of those lip tumors have been ulcerated for weeks or months, and have been more or less chronically infected. Under those circumstances it is only natural that the lymph nodes should become very much swollen, in many cases fixed, and with inflammation of the surrounding tissues. Neither can a hard consistence of the nodes be conclusive, as far as the diagnosis is concerned; because we know from our experience with glands in the neck, whether chronically tuberculous or non-tuberculous, that such glands in the submaxillary fossa particularly often are unusually hard and fibrous to the feel.

As regards the difference in the results obtained by the use of hard and soft rays, respectively, I would like to ask Dr. COLLIN if there weren't a larger number of more serious cases among those treated by the former than among those treated by the latter?

Finally, I wish to state as my absolute opinion that almost the same result can be obtained by contact radiation as by implantation. The difference is that the latter method is considerably quicker, and thus less costly to the patient; besides being easier and requiring less time of the operator. The treatment with needles can therefore in a larger number of cases be given as ambulatory treatment.

III. EDV. COLLIN: Dr. HEYERDAHL prefers implantation and distant treatment to contact treatment. I have tried all three methods; but I have come back to the last-named, as giving the safest and cosmetically finest results; besides which it is the one that gives least discomfort to the patient and is the most economical. The contact treatment must be given very carefully, however; as cross-fire radiation from both the outer and inner side of the lip; and must be assisted by prophylactic roentgen treatment, with soft rays, of the regional lymph nodes. I believe that my results justify me in taking this stand. As regards the lymph nodes, it is, of course, impossible to prove whether a gland is metastatic or infectious, before it has been examined microscopically. In those cases where extirpation took place, the gland proved to be cancerous; and in none of those cases has there been any recurrence. Barring the weight of a larger material, it hardly seems possible to come nearer to a proof.

Dr. EDLING, too, has doubts about the malignity of the nodes. I quite understand this; but I hope that a few more years' additions to these lip cancer cases will furnish the proof. I have not, in these present statistics, made any separation between graver and lighter cases; because I do not think that the prognosis depends absolutely on whether a cancer infiltrates to a greater or lesser degree; the only question, in that respect, being whether it infiltrates at all. The very large majority of my cases are infiltrating; of many of them the growth is very extensive, involving the greater part of the lip.

As to whether hard or soft roentgen rays should be preferred for treatment of the lymph nodes, I have simply wished to call attention to the remarkable difference so far as my results are concerned, and have then suggested a merely hypothetical — but, as it seems to me, rather plausible — explanation of that difference. There has not, of course, been anything, so far, to prove any connexion

between the cause and effect in these instances — and whether the task of furnishing such a proof shall be a matter for the physicist or the biologist I am unable to say; but we all know that the clinical, empiric observation is often the precursor of the experimental proof.

## IV. Jens Nielsen, Copenhagen: Observations on the Radiotherapy of Carcinoma recti.

(From the Radium Centre, Copenhagen.)

The author lays before the Congress a critical report of the results obtained at the Radium Centre of Copenhagen on the radiotherapy of 102 cases of inoperable carcinomas of the rectum, during the period 1913—26. In 10 + 23 cases, the treatment was by radium (contact) alone; in 43 cases by roentgen; in 26 by radium and roentgen combined. The results may be summarised as follows:

1) excellent palliative effect from roentgen alone;

2) undoubted, though not considerable prolongation of life as the result of combined roentgen- and radium treatment;

3) but only in very rare cases a true clinical healing.

Comparative analysis of the objective and symptomatic effects obtained from the different forms of treatment shows that only in two cases was absolute, clinical healing secured. Apart from these, complete disappearance of the tumor was only observed from the intrarectal application of massive, filtered doses of radium; but in all those cases there very soon came either a rapidly growing local recurrence, or distant metastases.

The average duration of life, after treatment, was longest after the combined roentgen- and radium treatment (30.5 months); considerably shorter after either roentgen or radium alone; shortest after the massive radium doses.

On the proctitis symptoms, the pain and the general condition, the roentgen treatment mostly had an excellent palliative effect, while on the hemorrhages the effect was not so certain. The palliative effect was less pronounced from the other forms of treatment. Finally, the author discusses the various other modes of treatment at present employed for cancer of the rectum — radium surgery, distant radium therapy and radium implantation. Of these, the implantation of gold-seed — gold-filtered emanation capillary tubes — seems to be the most promising.

### Discussion:

I. S. A. Heyerdahl: According to my experience, cancer of the rectum lends itself very badly to treatment by radium or roentgen. When one hears about the healing of an inoperable cancer recti, one is, in fact, almost inclined to doubt the correctness of the diagnosis. I remember one case, which was sent me as an inoperable cancer recti, and in which the symptoms disappeared after treatment by radium; but in that case the diagnosis had not been verified by microscopy. Macroscopically, it looked like a cancer; but it has hardly been so, because the tumor went down surprisingly quickly and easily, and ended by disappearing entirely after a while. It is my opinion that microscopical examination of the tumor should invariably be insisted on, whenever it is intended to use the case for statistical purposes.

II. GÖSTA FORSSELL: At the Radiumhemmet we have up to now used a technic similar to Dr. NIELSEN's, and with similar results.

All operable cases of cancer recti have been operated on. In a few instances an inoperable tumor became operable after treatment by roentgen. In those cases, the peritumoral infiltration disappeared after a short treatment, whereupon the case went back for operation. In cases of that kind, the important thing is, not to draw out the roentgen treatment, but to have the tumor operated as soon as it has become operable.

Of the 13 cases which we have thus treated, preliminary to operation, since 1921, 5 have remained free from symptoms so far. In four of them the observation time has not as yet been a full year; but in the fifth one the freedom from symptoms has now lasted four years. In 12 cases since 1921 we have given prophylactic after-treatment after radical operation. Of these, eight are still free from symptoms — 2 after observation for five years, 1 after three years, and 1 after two years.

Most of the inoperable cases that have been brought to the Radiumhemmet have been so far advanced that all treatment was considered as doomed to failure beforehand. Since 1921, we have treated 44, all with roentgen. During the first years we used a 0.5 mm. copper filter; but for two years, now, we have used zinc-copper-aluminum filter, as indicated by THORÆUS. In 31 of these inoperable cases there was no appreciable benefit from the treatment; in 7 there was a distinct improvement, but only for a short while; in 5 there was a quite considerable improvement, which has kept up — in 4 of them for four years, in the fifth one for a year. In one case the symptoms disappeared entirely, and the patient was in absolute subjective health for two years, after which recurrence set in and the disease made progress rapidly.

Of 14 cases, in which recurrence set in after operation, 9 failed to improve. In 3 there was improvement for a short time — about a year or so; in 1 case there is still freedom from symptoms after a year; 1 case remained free from symptoms for four years after ended roentgen treatment, but then recurred and grew worse in spite of renewed treatment.

A case from my private practise is essentially interesting. It is that of a man about 50 years old, with a large, ambient, fixed rectal tumor, which was considered as absolutely inoperable. Under roentgen treatment he became clinically free from symptoms. After consultation with the surgeon, Dr. HYBBINETTE, he was nevertheless advised — owing to our slight experience with this field of the radiotherapy — to have an amputation of the rectum performed, notwithstanding his freedom from symptoms. He consented; and the operation revealed no signs whatever of cancer; the mucosa looked normal. By the subsequent histological examination, however, cancer was found in a small gland close to the wall of the rectum. The already — after a considerable length of time — observed recurrences show that a long period of latency for such recurrences is possible.

The whole chapter of radiotherapy in cancer of the rectum is as yet in its infancy. The results from implantation of radium are not very encouraging, so far. For distant radium treatment in cases of that kind we have not, up to the present, had sufficient radium to spare. It is possible that a combination of radium therapy and surgery may lead us nearer to the goal. As a palliative therapy, roentgen treatment is valuable.

III. P. FLEMMING MØLLER, Copenhagen: To what has already been said by the speakers before me, I would like to add that, in my opinion also, the roentgen treatment undoubtedly has an excellent palliative effect in cases of cancer

of the rectum. And when, in addition to this, it is sometimes seen that the tumor disappears completely as the result of the treatment — then it seems to me that one cannot leave out trying with roentgen in inoperable cases of that kind. The cases given by Prof. FORSSELL I can supplement with two, in which I have myself seen the tumor disappear. One was a case of a severe cancer, substantiated by microscopical examination, with extensive infiltrations in the surroundings. In six months it disappeared so completely that it was impossible either by palpation or by means of rectoscopy to ascertain the existence of any tumor; and also the surrounding infiltrations had completely disappeared. One year after the treatment had ceased, the patient returned with metastases in the liver and abdomen. The autopsy did not show any macroscopically visible cancer *in loco;* but on serial microscopical examination a small isolated cancer focus was found — just as in the case described by Prof. FORSSELL.

The second case was a large cauliflower cancer, verified by microscopy, just inside the sphincter. It was scraped with a sharp scoop and then treated with roentgen. Tumor and the surrounding infiltrations became smaller, until the former was only about as large as a walnut. It was then extirpated, and there was no recurrence, at least for two years. Then the patient disappeared out of my range of observation, and I have not been able to locate him since. But the consequence of experiences like these is, of course, that one does not, henceforth, neglect to try with roentgen treatment.

IV. EDV. COLLIN: I wish to thank Dr. NIELSEN for his work of summarizing the results from the Radium Centre in Copenhagen. It is true that they do not teach us anything new or startling; but they confirm the impression that in irradiation with roentgen we have a good means for palliative treatment of cancer of the rectum, and one which, by combination with radium treatment, makes it possible to stave off stricture for a while longer. There is perhaps here a foundation on which a suitable therapy may be still further developed, especially by combining the treatment with the insertion of gold needles containing radium emanation.

V. JENS NIELSEN: We fully understand that the two cases of which I spoke lose a great deal of their importance by not having been verified microscopically; still, we are quite sure that clinical healing is effected by radiotherapy in at least a few inoperable cases of cancer of the rectum. But, in any case, that object is not to be attained by roentgen treatment alone, but requires intra-tumoral radiation.

## V. Nils Westermark: The Result of the Combined Treatment of Cancer mammæ at Radiumhemmet 1921—23 [1]

The investigation includes all cases of cancer mammae, 307 cases in all, that applied for treatment at Radiumhemmet during the period 1921—1923. Of these 52 cases were not treated. 162 cases have been given combined surgical and radiological treatment. Out of these 162 cases 75 have had post-operative radio-

[1] Published in extenso in this no. of the *Acta Radiologica.*

logical treatment, 45 have had radiological treatment before as well as after the operation and in 42 cases the radiological treatment has been combined with removal of the tumour by electro-endothermy. 22 cases of primary cancer have been treated only radiologically. The remaining 71 cases have on their admission to Radiumhemmet shown signs of recurrences and been treated radiologically. All the cases but 2 have been examined several times a year until their death or in the cases still alive, until the end of 1928.

To get some idea of the value of the radiological treatment I have compared the results obtained at Radiumhemmet with those obtained by surgical treatment of cancer mammae in Sweden.

The result of this comparison, as between cases of cancer mammae only treated by operation and those where the operation has been combined with radiological treatment, is as follows:

In cases treated surgically and radiologically a 5-year freedom from symptoms is obtained in a relatively greater number of cases. The surgical statistics in Sweden show a 5-year freedom from symptoms in 16.8—25.5 per cent of the cases. The cases treated post-operatively show a corresponding freedom from symptoms in 29.3 %, those treated pre-operatively in 40 %. The endothermic cases which in this investigation are of a much worse nature show a freedom from symptoms in 28.6 %.

The radiologically treated recurrences and metastases show freedom of symptoms in 9.8 % of the cases after a period of observation lasting more than 5 years.

The interval before any signs of local recurrence appear after the combined treatment is about the same as after the surgical treatment. On the other hand there is a very much longer interval before the distant metastases are manifest in cases treated with radiation and surgery than in those treated with surgery alone.

The local recurrences occur much less frequently after the combined treatment than after surgical treatment alone. After surgical treatment 55.7 % of the recurrences are of local nature. The post-operative group shows 48 % local recurrences, the pre-operative group 29.2 % and the endothermic group 12.5 %.

The duration of life after the appearance of the first symptom and after the commencement of treatment is in cases, who die of cancer, much longer after the combined therapy than after surgical treatment. Cases only operated upon have lived on an average 39 months after the appearance of the first symptom and 23 months after the first treatment, the cases treated post-operatively 49 and 31 months respectively, the pre-operative cases 61 and 41 months and the endothermic cases 67 and 37 months respectively. In comparison it may be mentioned that non-treated cases of cancer mammae live for an average of 31 months after the appearance of the first symptom.

## Discussion:

I. Gösta Forssell: It seems to me that the records from the Radiumhemmet, which Dr. Westermark has just presented to us, indicate to within a strong degree of probability that pre-operative roentgen treatment, in cancer of the breast, materially improves the results.

The principal effect of the pre-operative irradiation is undoubtedly that of reducing the vitality of the primary tumor to such an extent as to lessen the risk of its propagating itself in consequence of the operation; besides, as far as possible, to sterilise any possibly existing metastases in the immediate glandular region. It is possible that, in addition to this, a process of healing, set in motion through

the agency of this irradiation may result in a general strengthening of the resistance to tumoric growth.

The question as to the best method for this irradiation has not yet been settled, however. The most usual proceeding, I think, is to give one series of irradiations — on the tumor and in the axilla, respectively — and then to operate as soon as the first reaction has passed, but while the roentgen effect still remains; that is, about two weeks after the treatment. There arises the question, however, whether it might not be possible to obtain an increased resistance to the tumor growth by pushing the healing process farther — eventually until full clinical healing — before operating.

As I have pointed out in a work of mine, on the permanency of healing in malignant tumors[1], a number of observations seem to indicate that the radiological healing of a primary tumor produces an increased general resistence to neoplastic growth, in such a manner that any not yet fully developed metastases become more or less completely healed. If that is the case, the treatment ought, within the shortest possible time, to be continued until the tumor is very much reduced — or, if possible, until there is a complete absence of clinical symptoms — before operation takes place. As long as the tumor is continually reduced, the risk of any f r e s h formation of metastases from it is — according to our experience from other branches of the radiotherapy — very small. My personal conviction is that this is the road that should at least be attempted.

During the last year I have in a number of cases continued the treatment until the tumor had clinically disappeared; to obtain which I have given 2 or 3 series of treatment over a period of from two to three months. By the time the operation was made, the tumor had then either become transformed into a cicatrix of connective tissue, or else there were only slight residues of cancer to be found in a tissue of strongly scirrhous character. In none of those cases did the tumor show any signs of increased growth during the time before the operation; while the general condition of the patients improved. The treatment must be effected without either injuring the skin or prejudicing the general condition of the patient. The condition of the blood should be controlled. My method has been to irradiate through Thoraeus' zinc-copper-aluminum filter, with highly tangential irradiation and compression, and with the breast kept lifted high on the side away from the irradiation. From the outer side and medially on the breast, respectively, there are then given, in the first series, 3 times $^1/_3$ erythema dose, 6 exposures in all in the course of from two to three weeks; and 3 times $^1/_3$ erythema dose on the axilla. In the second series, after an interval of one month: 2 times $^1/_3$ erythema dose on each field; and, in some cases, in a third series: one or two exposures, of $^1/_3$ erythema dose each, according to the condition of the skin. By the time of the operation, two weeks after the last treatment, there is a light brown pigmentation, together with a slight, diffuse swelling. Shortly after the operation, an irradiation is given on the supraclavicular fossa on the same side, either with distant radium or with roentgen through Thoraeus' filter; and, if the condition of the skin permits, another irradiation on the axilla. On the field of operation, in the breast, irradiation is not repeated as long as there is still any cutaneous reaction. After about six months a fresh series of irradiations might possibly be given, through 0.5 mm. of copper (2 times $^1/_4$ erythema dose on two fields on the breast, on the axilla and the supraclavicular fossa); and still another after six months more; all, however, with strict regard to the

[1] *Acta Radiologica*, Suppl. II, 1928; LAZARUS: Handbuch der gesamten Strahlenheilkunde, II. Band, 3. Lief., 1929.

condition of the skin. I do not use to give any treatment on the other side, unless there is suspicion of metastasis. If the seed of metastases has already spread to the other side, the case is hopeless in any event; and it would then be time enough to start the treatment when they have declared themselves.

Exclusively radiological treatment we have only used in inoperable cases, or in cases where general contra-indications were found. If the tumor becomes operable as a result of the treatment, it is reasonable to advise operation, unless there are already clinical reasons — based on roentgen examination of the thorax and bones, for instance — to suspect that the cancer has become generalised.

Until we have gained some more experience, I still consider that operation should be made when possible. The patient gets the chance that the operation gives him, and the additional chance presented by the radiotherapy as well. The indications for a combined surgical and radiological treatment seem to me to be much wider, however, in the case of cancer of the breast than in the case of cancer uteri, where both the chances for a radical operation are less and the risks involved by surgical intervention greater. In cases where operation becomes a more risky matter, on account of either the patient's age or her constitution in general, it seems to me that the idea of cleaning out the axilla should be abandoned, and repeated seances of distant radium treatment on that point be adopted instead.

The extension of the radiation treatment to o p e r a b l e tumors as well must — as in the case of all other tumor therapy — come by way of the border-line cases. The results obtained elsewhere — at St. Bartholomew's Hospital in London, for instance — with buried radium needles, as well as WINTZ's statistics, seem to indicate that also the operable cases may eventually pass within the field of radiotherapy. But, in my opinion a long experience with the border-line cases will be necessary before that step is taken.

## VI. Jens Juul, Copenhagen: On Cumulation of Irradiation in Malignant Tumors, and the Therapeutic Effect of Irradiation with Massive and Divided Doses, and by the Saturation Method, Respectively; as Studied on Cancer Mice[1]

Ever since the biological side of the radiation therapy has begun to claim the interest of investigators concurrently with the physical aspect of that question, the influence of the time factor has become one of the problems most ardently discussed. From the clinical results obtained in the treatment of malignant tumors it is hardly possible, as yet, to determine whether the intensive or the protracted methods of irradiation give the best results. Also the experimental results are contradictory. On most objects in a condition of cellular activity the best effect has been obtained by giving the entire dose within the shortest possible time; but in a few other experiments the experience has been exactly the contrary; especially in those that have been made by REGAUD, SCHINZ and SLOTOPOLSKI on testicles, and by ALBERTI and POLITZER on the cornea of larvæ of the sala-

[1] Published in a fuller form as Supplementum IX of the *Acta Radiologica*.

mander. On malignant tumors in animals, only few experiments in that line have been made, and none from which any definite conclusions can be drawn.

My own experiments were made on mice with a transplantable adenocarcinoma. In the first set of experiments, different groups of the animals were irradiated with the same dose of roentgen, either in one brief exposure or in 3 shorter ones with intervals of from 12 hours to 3 weeks. The results in every case showed a better effect from the single irradiation than from the divided doses; and the effect was less, the longer the interval had been between the administrations of the partial doses. This would indicate that the influence of divided dosage is the same with regard to malignant tumors as with regard to other living tissues; namely, that the cumulation is incomplete.

At the same time, the effect on the skin of the animals — as judged by the epilation — was found to be considerably stronger from the single irradiation than when the dose was divided. But as the essential thing, from the therapeutical point of view, is the manner and proportion in which the irradiation reacts on the normal and the neoplastic tissues, respectively, it is not impossible that the therapeutical effect might nevertheless, in spite of this incomplete cumulation, be better from a divided dosage than from the single, full irradiation.

To investigate this, I irradiated two groups of mice, one in a single exposure, the other fractionally, with such doses that the skin effect on the two became the same; and then observed the effect in each case on the tumor. I also, at the same time, irradiated a third group according to the »saturation method» of PFAHLER, giving first a rather strong dose and afterwards several smaller ones, in such a manner that the skin effect was the same for all three groups.

The effect on the tumors proved feeblest in the case of those that had been irradiated with one, massive dose; somewhat stronger from the simply divided irradiation; and considerably stronger, again, from the dosage by PFAHLER's method. This was shown both by the growth energy of the tumors, by the average life time of the animals who died with tumor, and by the number of those in whom the tumor disappeared.

If any conclusions can be drawn from these experiments on mice with transplanted tumors to the case of spontaneous tumors in man, it would be that in the treatment of the latter protracted irradiation should be preferred to massive doses, and the saturation method to simple dividing of the dose.

## VII. Paul Jacoby, Odense, Denmark: The lethal Dose for Mice as biological Unit of Measurement

The author gives the results of some experiments in which he has tried to use a biological object as unit of measurement alongside of the very good physical methods of measurement which we now possess, and describes certain investigations which he has begun with a view to elucidating, by the aid of this method, some of the great problems still existing with regard to dosimetry. The present paper deals particularly with the effects produced by different qualities of roentgen rays; and, in that connexion, with the importance of the change which the Compton effect causes in the quality of the rays; but the author intends, by the aid of this method, to examine also other problems, such as the importance of time factor, the respective effects of massive and divided irradiation, the value of the saturation method, etc.

As biological object he has chosen white mice, and as biological measure the lethal dose for these animals, thereby understanding the smallest dose that will kill the mice in from four to twelve days from the time of irradiation. Under the experimental conditions established by the author, this has meant between 50 and 60 per cent. of the erythema dose, or about from 300 to 360 R. The mice were irradiated in some cases on the surface of a paraffin phantom, in others in 10 cm. depth of the latter, in order to obtain an irradiation of the animals as nearly as possible corresponding to the radiation which a portion of tissue of similar size in the organism must be supposed to receive.

In the first set of experiments, the quality of the primary radiation varied considerably, and the mice were irradiated on the surface of the phantom. The second experiment was identical with the first one; the only difference being that the animals were irradiated in the depth of the phantom. In both cases it was found that the effect of hard and soft radiation were practically the same.

A third experiment dealt with the Compton effect. In this case the primary radiation was the same all through, but the animals were irradiated, some on the surface, others in 10 centimeters' depth of the phantom. In the latter case they, consequently, received a considerably larger amount of secondary radiation, which, as shown by previous experiments of the author, are considerably softer than the primary radiation. Neither in this case was any difference observed between the effect of harder and softer radiation. The experiments further showed that the biological measure — the lethal dose for mice — closely follows the dose-indication of a physical measuring instrument, in this case a Siemens' dosimeter adjusted to units of R.

Finally, experiments were made of irradiating mice, some on the surface, others in 10 centimeters' depth of the phantom, in the same manner as employed when measuring the depth percentage in a phantom by means of a dosimeter. What the author calls »the biological depth percentage» seems to correspond rather closely to the physical depth percentage measured with the dosimeter.

## VIII. S. A. Heyerdahl, Oslo: Results of Radiation Treatment of Myoma of the Uterus and Menorrhagia

During the years 1912—27 has treated with roentgen or radium altogether 120 cases of myoma of the uterus and menorrhagia. The cases fall into two groups according to the technic employed.

Group I (1912—21): Feeble roentgen treatment with filtration through 3 mm. of aluminum; in 5 cases combined with intra-uterine radium treatment;

Group II (1922—27): Roentgen treatment of medium strength with filtration through 6 mm. of aluminum. Nothing but roentgen: 3 series, with an interval of from 4 to 6 weeks between each.

Of 63 cases in the first group, 8 had later to be operated on, because the hemorrhages continued in spite of either roentgen — or roentgen + radium treatment.

Of 57 cases in the second group, only 3 had to be operated on later on account of hemorrhages.

According to the experience of the author, the patient's age would seem to be a considerable factor as far as the result of radiation treatment is concerned, both in myoma of the uterus and in menorrhagia. If the patient is less than 40

years old, the case should better not be treated with roentgen unless the indications are against operation.

The indications for radiological treatment of these affections should be judged only by a fully experienced gynecologist. The mortality from roentgen treatment may be considered as nil. Complications from the roentgen — with the moderate doses used by the author — are not to be feared, provided the indications have been judged of correctly. Injuries to the skin, from the roentgen irradiations, may be regarded as entirely out of the question.

## IX. T. Dale, Oslo: Roentgen Treatment of Leucemia

The author describes a new method of treatment which he has used in 6 cases of myelogenous leucemia since February 1929.

General treatment (from front and back on alternate days): skin-to-focus distance, 1 m.; filter, 0.5 mm. of zinc; amperage, 2 milliamp.; 1 erythema dose = about 600 minutes' irradiation. With daily doses of 12 minutes, the irradiation was kept up for from 2 to 4 weeks; that is, the patient received from $^3/_{10}$ to $^3/_5$ of one erythema dose in all. In a few cases several treatments were given, with intervals of from 1 to 2 months between.

Improvement has been obtained in cases where irradiation to the spleen had failed. There was a noticeable increase in the number of erythrocytes, as well as considerable improvement of the general condition, as result of the treatment

### Discussion:

I. P. Flemming Møller: I believe Dr. Dale will reap some disappointments from his attempts with the treatment for leucemia which he has just described to us. Of course, only time will show whether the patients are going to last longer after his treatment than after treatment by the method usually employed; but as far as the immediate results are concerned, it does not seem to me, form the Tables Dr. Dale showed us, that they are any better than what may be obtained in other ways. I have myself for several years treated leucemia with highly fractioned doses, given at intervals of one or several days, precisely in order not to bring about that sudden drop in the number of leucocytes which produces the strong general reactions and may become fatal to the patient. Irradiation to the spleen in this manner, with small doses each time, produces just that same improvement in the general condition of the patient, which Dr. Dale speaks about. The number of white corpuscles decreases slowly, and the number of the red ones increases in like manner; and, what is curious, by the end of the treatment the number of the white corpuscles has not yet come down to the normal, but continues to decrease evenly and slowly until a couple of months after. I consider it a theoretical error to treat a myelogenous leucemia with large doses at one time; but whether the more cautious treatment keeps the patient alive for a longer time is a great question. That time undoubtedly depends on the malignity of his case, and on nothing else.

II. S. A. Heyerdahl: The method used by Dr. Dale for roentgen treatment of leucemia I have never seen employed before. So far, it has given excellent results, and we are watching the further development with great interest. The general roentgen treatment at 1 meter's distance I have tried in one case of gra-

nulomatosis, which I venture to bring before you. The case is from the Medical Dep't B. of the Rikshospital, und was diagnosed as malignant granulomatosis.

The patient, O. B., was a labourer; he had always been in good health previously, and had worked as a wood-cutter and at field work. In the spring of 1924 he got seeping hemorrhages from both sides of the nose. Next day there was stiffness and pain in both calves; later in the day there came subcutaneous bleeding in large patches of both feet and calves, as high up as to the knees. On the same day he observed that his urine became very sanguineous. This lasted for a couple of days. At about the same time he began to get seeping hemorrhages from the gums, as well.

The hemorrhages ceased in the course of two or three days; but afterwards he felt weak and slack, was very pale, and kept his bed for a month.

He had never noticed any tendency to hemorrhages before. His diet, during the past winter, had been of the same kind as he had been living on many winters previously. Nor had any of his fellow-workers, who had been living on the same fare, become ill.

Since that time the man had never fully recovered his strength. Still, he had been able to continue with his usual work. He has never had hemorrhages since.

By new-year's time, 1927, he noticed an incipient swelling of the glands in the right side of his neck. They grew larger gradually and rather quickly. There was no tenderness; no pain; no symptoms of fever. He continued with his usual work all the time.

By October, 1927, the tumor had grown to the size of two clenched fists; so at the end of that month he was admitted to the hospital at Drammen, where, according to statement, 40 glands were removed. A number of these were sent for examination to the Pathoanatomical Institute of the Rikshospital, which returned the diagnosis: Malignant Lymphogranulomatosis (Microscopy: Large, swollen mononuclear cells rich in protoplasma; and giant cells of the Sternberg type, with several nuclei in the central portions.) During the patient's stay in the hospital there was also discovered a gland, fully as large as a walnut, in the right axilla.

He remained in the hospital about two weeks, whereupon he resumed his work. He was still feeling languid and tired, however; and this feeling has been growing continuously more pronounced. Of late, he has felt exhausted and become short of breath when he worked. In the right side of his neck there again began to develop glands, and by the 10th of October, 1928, these had become as large as a hen's egg. Also in the right axilla glandular sweellings began to develop; and later there came a considerable swelling of the right arm and hand, which subsided, however, in about a week's time. During all this time he was nevertheless up and about, and in a general way felt fairly well. There were no signs of fever, no night sweats, no dyspepsia. During the past year he has become rather thin. Three years ago he weighed 158 pounds; now only 130.

On October 10th, 1928, he was admitted into the Rikshospital, Medical Ward B. At the time of admission, observations were as follows: Patient is thin and pale, sclera slightly icteric. No special complaints. *Temperature* (resp.), 37.7. *Pulse*, 76, regular. *Respiration*, 18, easy. *Roentgenogram* of thorax, normal. *Neck:* Just below the right angle of the jaw is a swelling, smooth and about the size of a hen's egg; and here, underneath the sterno-cleido muscle on the right side, is felt a nodular mass, the single composing nodules of which cannot be distinguished by palpation. In the right supraclavicular fossa is another mass of nodules about as large as a hen's egg, the individual nodes ranging in sizes from that of a pea to that of a hazel-nut. These lymph nodes are all of a firm consis-

tency, and are not tender to the touch. *Thorax:* The veins of the upper part of the right side of the thorax, and of the right upper arm, are dilated. Over the right pectoral muscle there is a smooth, even swelling. In the right *axilla* is a nodular lump as large as a clenched fist, the single nodules of which cannot be differenced by palpation. In the left axilla and in both sides of the groin are felt a number of firm, movable nodules from the size of a grain to that of a pea. They are not tender to the touch. No glandular swellings elsewhere. — Heart, lungs, abdomen, liver and spleen normal. Urine normal. Basal metabolism, 89.61 per cent. Roentgenogram of thorax, normal.

1st roentgen treatment, Oct. 26th to Nov. 1st, 1928: $^1/_2$ erythema dose on 4 fields over neck and axilla. — Nov. 30th: Patient has been poorly for the last week, with irregular, slightly feverish temperature. No visible change in the lymphoglandular masses.

2nd roentgen treatment, Dec. 14th to 21st.

Dec. 22nd: Objectively, no marked change. The patient's general condition is now poor; of late, his temperature has been irregular and somewhat above the normal. The lymphoglandular mass has perhaps become a little softer, but is of the same extent as before. — The man was now discharged; but he re-entered the ward on Feb. 25th, 1929. By that time he had become a little better, did not feel quite so weak, and the tumors had become smaller.

3rd roentgen dose ($^1/_2$ erythema dose, as before), Feb. 22nd to March 4th, 1929.

March 5th: The patient now feels perfectly well. He is discharged, but is told to present himself again in two weeks.

March 21st: Patient returns for roentgen treatment. He is pale, but looks well otherwise. Tumor and physical condition as on Feb. 25th.

4th roentgen dose ($^1/_2$ erythema dose, as before), March 25th to 27th; on neck, axilla and tumor of thorax. The lymph nodes in neck and axilla are about what they were at the time of his first admission; tumor in thorax likewise. — Roentgenogram of thorax, March 25th: Large hilus shadows on the right side; otherwise lungs clear, movements of diaphragm good, sinuses clear.

April 29th: The patient reports again, as arranged, for renewed roentgen treatment. Since last discharged he has been feeling comparatively well; but his appetite is poor, and he has lost weight. He looks pale and sallow; is thin. Pulse, 100. Temperature, 37.8. Respiration somewhat labored. The glandular swelling has increased some since March 21st, especially in the right axilla, where a lump about as large as a pigeon's egg is felt. The veins are distinctly traced in the right upper arm and right side of thorax. *Lungs:* Slight dulness over both posterior surfaces from middle of infraspinous region to base; respiration weakened. *Liver,* 4 fingers' breadth below costal margin. *Spleen,* much enlarged; lower pole on level with iliac crest. *Abdomen,* somewhat dilated; no ascites.

5th roentgen treatment, April 30th to May 29th: $3 \times {}^1/_5$ erythema dose, distance, 1 meter; filter, 0.5 mm. zinc; spark length, 45 cm. In all, $^3/_5$ erythema dose.

May 30th, 1929: When the patient came in for treatment he was in a rather poor state. He was pale, his general condition might best be described as cachectic. There was considerable fever, positive diagnoreaction. — He has now been given general roentgen treatment, and has improved considerably. Since May 11th his temperature has been normal; the general condition has become better; the diagnoreaction has disappeared. The lymph glands have receded considerably; they are now much smaller and much softer. The liver can no longer

be felt below the costal margin. The milt can still be palpated. The patient is less anemic.

| *Examination of the blood:* | May 2nd. | May 8th. | May 14th. | May 29th. |
|---|---|---|---|---|
| Hemogl. Percentage . . . . . | 45 | 48 | 58 | 57 |
| Number of red corpuscles . . . . | 3.810.000 | 4.130.000 | 4.150.000 | 5.340.000 |
| » » white » . . . . | 5.400 | 4.000 | 5.000 | 4.600 |

## X. Sv. Lomholt, Copenhagen (J. C. Jacobsen and Sv. Lomholt): A new, practical Method for the Use of Radium in the Treatment of Skin Diseases

At the last congress of the N. A. M. R., in Copenhagen, I described a method for the use of radium emanation in the treatment of skin diseases[1]. The emanation was absorbed into melted wax, which was afterwards cast in thin sheets, and these cut in suitable pieces and applied to the patches of skin to be treated. In order to lessen the loss of radiation from absorption, we have since — and with good results — altered the technic as follows: The emanation is now absorbed into finely pulverised charcoal, and this spread evenly, by means of a brush, on court plaster, which is then cut in pieces and applied to the skin. In this manner, not only is the Beta-radiation utilised to the full, but also a great deal of the Alpha-radiation.

## XI. Jens Nielsen, Copenhagen: Four Hundred Cases of Angioma treated with Radium (A Report from the Radium Centre, Copenhagen)

The fundamental principles of the technic used at the Radium Centre in Copenhagen are, always to employ suberythemal, elective doses, and never to start on a new treatment before the preceding one has run its complete course. The treatment extends over from one to two years, with long intervals — of 2—3—4 months or more. The standard form of treatment has been with plates, about 1 milligram of element to each $cm^2$, 0.1 millimeter lead, 3 hours.

Adherence to this technic has given the following results in 415 cases of angioma (354 cavernous, 55 capillary, 6 venous) treated during the period 1913—26 and observed for one year or more after the treatment has ceased.

Cavernous angioma: cured, 90 per cent.; cured, but with after-effects from the radiation, 7 per cent.; no response, 3 per cent.

The prognosis for the final cosmetic result will rest on 1) the age of the patient, 2) the growth energy of the angioma, 3) its consistency, 4) its situation.

Capillary angioma: *Small* angiomas (4) all largely improved; *extensive* ones (51): cured, none; improved, 40 per cent.; no response, or disappeared only with serious radium effects, 60 per cent.

From these results, the radio-resistance of the telangiectases must be considered so great that an appreciable decoloration cannot be obtained except by repeated, reactive radiations, entailing the risk of serious atrophic changes.

---

[1] See: Report of Proceedings of the Fifth Congress of the Northern Association of Medical Radiology, 1927; p. 605.

Venous, cirsoid angioma: Only in one of the 6 cases was some improvement obtained after many applications.

Angiosarcoma: 3 cases, verified by biopsy, were all lastingly cured.

In 1 case of angiomatosis of the retina (Hippel's disease) the treatment seems to have been effective in arresting the growth.

Lymphangiomas (29 cases) react, but are somewhat less radio-sensitive.

A comparison of the radium treatment with other therapeutical methods leads to the conclusion that radium is superior, except for relatively small, superficial, rather stationary angiomas, which several simpler methods of treatment, such as freezing, hot air or electrolysis, will cure speedily and with good cosmetic results. Surgical extirpation is superior only as regards speed, but not cosmetically. With regard to the flattened vascular marks, radium treatment, like all other treatment is more or less ineffective.

**Discussion:**

I. Edv. Collin: I wish to compliment Dr. Nielsen on the great work he has done, in after-examining this large number of children and collecting the whole material from the Radium Centre in Copenhagen. The results have turned out even better than expected, and I believe that the simple, time-saving method we use gives as good results as it is possible to obtain from the radium treatment of angiomas.

II. Svend Lomholt: In cases of capillary angioma (nævus flammeus) a decided improvement can be obtained by a combination of $CO_2$ and Finsen treatment. The treatment should begin with freezing for about 10 seconds, then the blister formed should be removed with the aid of scissors and forceps, the suppurating surfaces rendered anesthetic by application of a compress with a thin solution of cocaine, and finally the Finsen treatment be given, with doses about one third the strength of the ordinary dose for lupus. The treatment is rather circumstantial, as it has to be repeated several times. A considerable decoloration is obtained. It may not be entirely uniform; but this should not be too much regretted, because, cosmetically, a slight unevenness of coloring precisely gives a less pronounced effect than the entirely uniform surface, whether the latter be dark red, as before the treatment, or of the smooth, white appearance resulting from an intensive treatment that has radically destroyed all vascular tissue. I think it is undoubtedly advisable to stop the treatment at that stage, even though its continuation might probably lead to the bleaching becoming complete. That a very light nævus flammeus had better be left alone, I quite agree with Dr. Nielsen.

## XII. M. Norland, Stavanger, Norway: Two Years' Experience with Bucky's "Soft Ray" Treatment

The author states that in the beginning the results were not very good, and were made uncertain owing to wavering in the matter of dosage and differences in the prestations of the tubes. — Lindemann's fenestrae not being sufficiently uniform in thickness.

With proper and exact dosage, one will generally observe »preliminary reaction» within the first few days, but it soon disappears again. About the 11th day

comes the true reaction, which resembles the ordinary roentgen reaction of the 1st degree. This disappears in the course of from one to two weeks, and as a rule leaves an improvement. Any appreciable, lasting pigmentation has not yet been observed by the author.

For screening, the author uses tinfoil or, with strong doses, lead. For fixation, he uses leucoplast. His experience is that the rays are at least relatively harmless; even when the higher of the doses given below were exceeded, the reaction only lasted from three to four weeks, and disappeared without leaving the slightest ill effect. After nearly twenty years' practice with ordinary roentgen rays in the treatment of skin diseases, the author has now gone over, almost entirely, to the use of »soft rays». Of the general treatment, so strongly recommended by Bucky, his experiences are as yet too few to permit of any pronouncement on his part, but he is going on trying it. Fifty lantern slides of patients before and after treatment are shown.

The author has treated 271 cases. They were the ordinary forms of chronic eczema — many of them years old, and refractory to the usual treatment; acne vulgaris, psoriasis, lichen ruber planus, lupus erythematosus and vulgaris, nævus pigmentosus and verrucosus, and angiomata, of which several were strongly hypertrophic. Beside these, several other cutaneous and nail affections have been treated, but are still in the experimental stage.

Apparatus: Koch and Sterzel's »Dermix». Tube: C. H. F. Müller's »Weichstrahl», with circulating water cooling. Dosimeter: Küstner's.

**Dosage.**

| | *Max. K. V.* | *M. A.* | *Distance* | *Time* | |
|---|---|---|---|---|---|
| *Chronic Eczema* . . | 8 | 10 | 10 cm. | 10 min. = 500 R. | (by zones) |
| | or 9 | 10 | 2.5 » | 1 » = 800 R. | |

*Average needed*: 4 treatments. *Free intervals:* 14 days. *No. of cases treated:* 93.

| | | | | | |
|---|---|---|---|---|---|
| *Acne vulgaris* . . . | 8 | 10 | 10 cm. | 10 min. = 500 R. | |
| | or 9 | 10 | 2.5 » | 1 » = 800 R. | (by zones) |

*Treatments:* 3 to 4. *Free intervals:* at least 3 weeks. *No. of cases treated:* 17.

In the large majority of cases, the result has been very good and lasting; though, of course, recurrences now and then set in, which required renewed treatment. In these skin diseases, dietary prescriptions were given, besides.

| | | | | | |
|---|---|---|---|---|---|
| *Psoriasis* . . . . . | 8 | 10 | 2.5 cm. | 1 min. = 400 R. | |
| | or 9 | 10 | 5—10 » | 1 » = 100—200 R. | |

*No. of treatments:* 2. *Intervals:* 14 days. *No. of cases:* 9. The results have been better than from ordinary roentgen treatment; but also with this method recurrences happen after a while.

| | | | | | |
|---|---|---|---|---|---|
| *Lichen ruber planus* | 9 | 10 | 2.5 cm. | 2 min. = 1600 R. | |

*No. of treatments:* 6. *Intervals:* 2—3 weeks. *No. of cases treated:* 3. — *Results:* good.

| | *Max. K. V.* | *M. A.* | *Distance* | *Time* |
|---|---|---|---|---|
| *Lupus erythematosus* | 9 | 10 | 2.5 cm. | 1 min. = 600—800 R. (by zones) |

*Intervals:* at least 3 weeks. *No. of cases treated:* 15; of which 4 have been discharged with good result, while the rest are still under treatment.

*Lupus vulgaris* . . . 9 10 2.5 cm. 3—8 min. = 2000—4000 R.

*Intervals:* 4 weeks. *No. of cases treated:* 11; of which 3 discharged with good result; 2 of these being recurrences after provious roentgen treatment by other methods.

The cosmetic results, both as regards this and the foregoing group, is very good. The prospects for the cases still under treatment is encouraging.

*Nævus* . . . . . 11 10 2.5 cm. 3—5 min. = 1500—4000 R. (by small zones)

*No. of treatments:* 4. *Intervals:* 1 month. *No. of cases treated:* 2, one of which was a nævus verrucosus. *Results:* very good, also cosmetically.

*Angioma* . . . . . 11 10 2.5 cm. 4—5 min. = 2000—4000 R.

*No. of treatments:* 4. *Intervals:* 1 month. *No. of cases treated:* 5, of which 3 with excellent result; the 2 others still under treatment.

## Discussion:

I. SVEND LOMHOLT: We have made trials with Bucky's »soft ray» treatment for two years at the Finsen Institute, and I have tried it in my private practice besides. We have not found that it gave us anything that we could not just as well or better obtain by other methods, especially, for instance, by unfiltered or slightly filtered roentgen treatment, or by the treatment of which I spoke myself a little while ago, with radium emanation in wax sheets or absorbed into pulverised charcoal and spread on court plaster. For acne vulgaris it is my opinion that treatment with mercury quartz light is to be preferred.

Bucky's soft ray treatment has the great inconvenience of being very laborious, owing to the smallness of the field of irradiation. And even apart from that, it is not without certain disadvantages. We have more than once — with the recommended tension of from 9,000 to 10,000 kilovolts in the likewise recommended doses — seen instances of vascular dilatations and atrophy of the skin. But for that one must, of course, be prepared, if the rays are so penetrating that they can have any effect on epitheliomas.

With regard to the attitude of the Germans toward the method, my impression is not so optimistic as that of Dr. NORLAND. The question was very thoroughly discussed at the Congress of Dermatology in Dresden a couple of years ago, but only one of the speakers expressed himself as really glad for it. Most of them did not find that this method of Bucky's, as far as the therapy of skin diseases is concerned, gave us anything better than the treatments hitherto known; but found, on the contrary, that it was more laborious, and by no means free from troublesome after-effects.

II. GÖSTA FORSSELL: I have listened with great interest to what Dr. NORLAND has told us about his results with Bucky's »soft ray» treatment in benign

affections of the skin. But I have been rather terrified at seeing him attempt to treat deep-going skin cancers by that method; for instance, the case in which the tumor evidently infiltrated the ethmoid cells, and that other one, in which it was plain that the nasal cartilage was involved. Dr. NORLAND was satisfied with the result of the treatment. But to an experienced eye it is immediately clear, even from the photographs, that only a superficial healing has taken place, and that the tumor still exists in the depth. I cannot sufficiently caution against the use of this »soft ray» method in the treatment of cancer. We all know it as a necessary condition for obtaining the healing of cancer tumors by irradiation that the tumor tissue should absorb a certain quantity of rays. The »soft rays» are absorbed by the outermost layers of the skin, and therefore lack all the qualities necessary for being useful in the treatment of cancer. We do not know how deep a seemingly altogether superficial cancer may in reality extend. From the infancy of radiotherapy we know the dangers attaching to a superficial healing by means of »a little roentgen». After a while the tumor begins to grow again, and in many cases it is afterwards impossible to save the patient without resorting to large and crippling operations. Cancer of the ethmoid region is one of the most difficult to deal with radiotherapeutically, and demands all the resources of the radium technic. The treating of cancer by radiotherapy should be done only in institutions fully equipped for that purpose, and is not a proper object for experiments by unpracticed hands. The patient's own wish to be treated is not sufficient indication for the treatment. We all admire Dr. NORLAND for the pioneer work he is doing in the service of roentgenology, away up in a distant part of the North; but it is the duty of the hospital authorities to see to it that the patients can get access to such facilities as are required for the radiological treatment of tumors.

## XIII. T. Dale, Oslo: On Roentgen Examination of the Lung, compared with the clinical Diagnosis and Post-Mortem Findings

The author's report deals with the examination of the lungs in 35 bodies, 2—3 hours after death; the post-mortem findings (Post-mortem Protocol of the Pathoanatomical Institute of the Rikshospital, Oslo) being compared with the clinical diagnosis and the result of the roentgen examination.

In 12 of the cases examined the lung was found to be normal; in 23 there were pathological changes.

The observations in the following cases are given: 3 with long-seated tuberculous affection of the apex and thickening of the pleura; 3 with extensive tuberculous changes in both lungs; 2 with miliary tuberculosis; 1 with pleural exudation; 1 with abscess of the lung; 1 with gangrene of the lung.

The affection of the apex and the miliary tuberculosis had not been demonstrated clinically. The roentgenological picture, on the other hand, except in 1 case of miliary tuberculosis, showed all those changes, typical of the diseases named, which were afterwards found by examination post mortem.

In 2 cases did that examination show the existence of caverns, and in 1 case of abscess in the lung, of which the roentgen picture had not given any indication.

In conclusion, the author points to the difficulties of specially roentgen-diagnosticating the different affections of the lung.

**Discussion:**

1. GÖSTA FORSSELL: I wish to compliment Dr. DALE for the very fine initiative he has shown in undertaking this systematic exemination of a series of human lungs immediately after death. Of course, photographing of dead subjects has been done before for the same purpose; but with less positive results, because the examination took place too long after death. Dr. DALE's work shows us finely that the radiogram taken very shortly after death gives a picture of the lung very nearly as it was when the person was alive. This is of great importance for our anatomical control of the roentgen pictures.

The scientific study of the roentgen diagnosis is, of course, based chiefly on an exact comparison of the anatomical structure of the organ in question with the projected picture which the roentgenogram gives of the »roentgen-structure» of the same organ. If such a comparison is to be made, it is necessary, however, that a strictly anatomical viewpoint should be maintained in the description of the roentgen findings. The description must aim to find and establish in the roentgen picture all the anatomical formations and pathologic features, and the terminology used must be anatomical. Thus, we do not get any further if, for instance, we content ourselves with speaking simply of »the hilus shadow». We must, in the description of the hilus, seek to differentiate the anatomical details — that is, these details such as they are projected in the picture — from such pathological details as, for instance, glands and perivascular or peribronchial infiltrations, or subpleural exudations. Another necessary requirement is that the observer uses a technic which makes possible the investigation of details; for instance, projection from various direction, and examination with light of various degrees of penetration.

## XIV. Nils Westermark: Studies on Acute, Massive Collapse of the Lung [1]

In the course of some earlier studies, made by H. C. JACOBÆUS, G. SELANDER and myself, concerning the emptying of the bronchi following the injection of lipiodol, we had occasion to observe a number of cases of acute, massive collapse of the lungs in connexion with the introduction of lipiodol into the bronchi. In the present paper I have given an account of our joint experiences with regard to this subject, from certain hitherto unknown points of view.

In the first group are described 3 cases of acute, massive collapse — 2 complete and 1 partial — after hemoptysis in connexion with acute pulmonary tuberculosis.

In the second group are described 2 cases of acute pneumonia followed by acute collapse.

The third group comprises 4 cases of collapse after injection of lipiodol into the bronchi. It is about this group that the interest principally centers, because it is here possible to follow the collapse from its beginning, through its development and until its disappearance, better and more closely than has been the case before.

In contrast to the collapse of the lung which, in animal experiments, is produced by reducing the capacity of the bronchi, and where the collapse is not observed in the roentgenogram until 4 or 5 hours after, the collapse resulting from

[1] Published *in extenso* in the *Acta Medica Scandinavica*, vol. LXXXI, p. 439.

the lipiodol injection occurs within 10 or 15 minutes. Its degree and extent has no relation whatever to the filling up of the bronchi with the fluid. We have therefore suggested the possibility that the collapse of the lung is not due to the lipiodol alone, but to the intervention of still another factor; namely, a simultaneous spasm or contraction of the bronchi. Such a spasm or contraction we have also been able to observe directly.

Our experience so far seems to indicate that atelectatic collapses of the above-named types occur in cases where the bronchi are in a normal condition. In our opinion, spasm and contraction of the bronchi occur only in cases of normal bronchi, and are a characteristic which disappears when pathologic changes take place in the latter. In pathologically altered bronchi no atelectatic collapse occurs, either after hemorrhage or after lipiodol.

## XV. Svend Lomholt, Copenhagen: The Biological Basis for the Use of Light as a Therapeutic Agent

The author very concisely reviews the essential points concerning the physical properties of the light rays, and the character of their biological effects. The ultra-violet portion of the spectrum — the range from 280 $\mu\mu$ to 400 $\mu\mu$ — must still be considered as the most important. Small quantities have an »inciting» effect (FINSEN), larger ones a lethal, on cells and microorganisms.

The shorter the waves of a ray, the larger its biological activity; but the feebler, also, its penetrating power. This must be remembered when it is a question of chosing a source of radiation with due regard to the effect it is desired to obtain. SONNE found that 35 per cent. of the visible light is reflected by the skin. A number of various experiments made by the author confirm that figure rather closely.

On the basis of other, recent experiments the author himself has established the penetrating power of different rays. The thickness of the »halving-layer» for orange rays he found to be: of live, exsanguined skin, about 1.3 mm.; of dead skin, 1.0 mm. The absorption in the blood was, as regards this portion of the spectrum, quite inconsiderable. Of the radiation of this quality, a layer of blood 0.3 mm. thick absorbs only about 50 per cent. A series of experiments went to show that hardly any biological effect can be attributed either to the visible luminous rays or to the blue and violet ones. Even the strong ultra-violet band in the carbon arc, at 388 $\mu\mu$, has only a rather feeble effect. It takes from 10 to 15 minutes' irradiation from an ordinary Finsen lamp to produce a slight erythema. But the same radiation is fairly penetrating. It will, thus, give a slight erythema through shaved rat-skin from 0.7 to 0.8 mm. thick, but only after from 3 to 4 hours' irradiation. The halving layer may be estimated at about 0.18 mm. Also of the emissory band at 366 $\mu\mu$ in the mercury lamp the biological effect was found to be rather slight, and the halving layer was measured to 0.14 mm. For the strong line at 313 $\mu\mu$, the biological effect of which is very pronounced, the halving layer was found to be about 0.07 mm., and with this radiation a visible effect could be obtained even to a depth of 0.5 mm.

The action of the light rays on the cells — and particularly on any pathologic cellular infiltrations — is a peculiarly selective one, and this is of great practical importance as regards their use in therapy — specially when it is a question of *local treatment with concentrated carbon-arc light*. It makes possible the preservation of the structure of the skin, and healing with a nice, smooth cicatrisation.

If, in local treatment, a certain deep effect is desired, carbon-arc light should be used; while, with the mercury light, a particularly strong surface effect is obtained. Therefore, carbon-arc light is the best for the treatment of lupus, neurodermitis, etc.; while acne and similar disorders are best treated with mercury light.

Of the manner in which the *general light-baths* produce their action only little is known. In rickets it is supposed that their effect is due to their activating influence on substances in the skin of a character similar to ergosterin. What makes them so effective in tuberculosis has not yet been definitely ascertained. That it should be due to their heating action on the blood in the upper layers of the integument — as formerly believed by SONNE — is hardly probable, seeing that the maximum temperatures raised in the skin, as measured with a toluol thermometer, did not lie much above ordinary fever temperature.

## XVI. V. Thorsen, Copenhagen: On the Distribution of Energy in the Ultra-violet Portion of the Spectra of different Carbon-Arcs (with a special view to the measuring of doses)

The emission of ultra-violet light from a carbon-arc can be materially altered by the addition of various salts to the wick of the carbon. The emission, as function of the wave-length within the 400 to 300 $\mu\mu$ range, has been investigated by the author as regards a variety of carbons; namely, Siemens' ordinary »Docht», »A» and »Nickellicht»; and the ones from the National Carbon Co. marked: »Therapeutic A, B, etc. . . . to: K».

The ultraviolet energy beyond the so-called cyanic bands will in many cases be considerably increased, while the intensity of those bands themselves usually becomes reduced, though in varying degrees.

As far as the range here investigated is concerned, the ordinary »Docht» and the »A» carbons have exactly the same spectral composition. This is generally the case with all carbons whose wicks are composed of silicates of sodium. The reason is that wicks of that composition do not have any material influence on the emission, but serve chiefly to make the arc burn more steadily, specially by making the position of the positive crater firmer. Among the »Therapeutic» carbons, on the other hand, there are several that give a considerably increased intensity, owing to their containing metals whose spectra are rich in lines. To this it should be added that several of these carbons burn with a lower polar tension, thus making it possible to get a several times greater yield out of every watt.

With regard to the radiation from ordinary »Docht» carbons it is necessary to distinguish very sharply between crater radiation and the radiation from the arc. The former, which is a continuous radiation, is proportional to the strength of current in the first power; the latter (the cyanic bands) proportional to the strength of current in the second power. The ordinary formula for the intensity of the cyanic bands is: $I = k \cdot i^2 \sqrt{V - V_0}$; $i$ being the strength of current (in ampères), $V$ the polar tension (in volts), and $V_0$ a constant, with a value of about 43. This formula holds good for tensions of from 48 to 60 volts (0—25 amp.).

As the intensity has hitherto been taken to be simply proportional to $I$ itself, it is evident that the formula here given will be valuable for determining the dosage, specially because it gives us a means of calculating the dose. Thus, at 10

ampères the intensity of the continuous radiation is about the same as that of the cyanic bands; but if the current is increased to 20 ampères the cyanic bands, consequently, become twice as strong as all the rest of the continuous radiation together.

It was also found that the intensity of the radiation from the arc depended in a considerable degree on the position of the carbons — especially on that of the positive one. The formula given above probably holds good in any case; but with the positive carbon underneath and perpendicular the value of $k$ is almost 3 times as high as with the positive carbon as upper one, also perpendicular.

## XVII. G. Runström, Västerås: A Contribution to the Roentgen Technic for Examination of the Temporal Bone, in Cases of Chronic Changes Originating from the Ear

The roentgen diagnosis of changes in the temporal bone, in cases of chronic changes originating from the ear, has not been paid sufficient attention to — no doubt because a defective technic has not given sufficiently good practical results. Since 1926, however, a relatively large number of cases, all verified by operation, have shown me that, with a suitable technic, good information can be obtained in that way.

The first condition is that the pictures should be sharp and rich in details. The complicated anatomy of the temporal bone, with its cell system, facial canal, labyrinth and sinus, make even the pictures most full of detail difficult to analyse. Good stereoscopy will to a great extent do away with those difficulties, and the plastic picture gives a remarkably clear insight into the topographical conditions.

Sharpness of the picture is obtained by a careful technic of screening out. With the object to be investigated so small as the present one, primary screening is preferable to secondary. There is a difficulty of focalising the object exactly in different projections with a beam of rays so strongly narrowed — a difficulty which becomes all the greater by the fact that the stereoptical technic demands 2 pictures in each projection; but by using the special table for cranial examination constructed by Lysholm it is possible to carry out the details of such a technic in a precise manner, without difficulty, with small diaphragms. By means of a simple tube arrangement, each pair of stereo-pictures is taken on one 13 × 18 cm. film. A focus displacement fairly corresponding to the distance between the eyes is obtained by moving the tube about 5 degrees.

The principal projections are: *I*) The head placed sideways. The central beam back of the external auditory meatus. The direction of the beam 15 to 20° cranially and 5 to 10° dorsally. It can be very useful to take one stereo pair at 15° and another at 20° cranially, with same displacement dorsally for both. Those four pictures can be combined so as to make six pairs of stereos, whereby the diagonal ones get a wider base.

This projection is the most important one, and will often suffice. If necessary, it may be supplemented with a dorsal displacement of 15 to 20°. For further analysis, orthoprojections in axial and frontal direction are very valuable.

*II*) Axial orthoprojection. Head sideways. Central beam on angle of the jaw. Direction, 30° cranially and 5° dorsally.

*III*) Frontal orthoprojection. Head sideways. Central beam on lateral border of orbit. Direction, 30—35° dorsally and 10° caudally.

An important point of the technic is to have the exposure and the quality of the radiation adjusted according to the character of the object. With an amply pneumatic mastoid process, a soft quality of radiation brings out the cellular structure best. On the contrary, if there is a pronounced sclerosis, that technic will bring out only the sclerotic condition; and the latter may completely hide any possibly existing destruction — for instance, a cholesteatoma — which, on the other hand, would be brought out in a graph produced by thorough exposure with a harder quality of radiation.

Sufficient sharpness will usually be obtained by the use of a diaphragm leaving a picture about 6 cm. in diameter, which is also sufficient to cover the object of examination. Sometimes an even stronger screening off may be to advantage. The primary screening may be further intensified by placing close against the wall of the tube a second diaphragm, with an opening 1 cm. in diameter, by which the secondary radiation from the tube wall will be eliminated.

A good way of studying the pictures is through a prismatic stereoscope, such as Stumpf's »stereo-binocular», for instance; or, if greater magnifying is desired, with Lysholm's telescopic stereoscope. The simplest, however — if one can do it — is to look at them without optical instruments, simply by turning or slanting them so as to get the composite view of them. Owing to the technic, the exact stereoscopic picture gives the object as seen from inside the skull outward. It can even be useful by reversing the pictures to get the view of the object as seen from outside, even though, in that manner, the stereoscopy isn't quite exact.

The changes one notices are such that produce differences of density: consolidations in the cellular system, changes in the calcareous contents — sclerosis or petrifaction — and, last and most important, chronic abscesses, granulation-filled cavities and cholesteatoma. Of course, changes of this kind may generally be diagnosticated clinically, and the indications for operative intervention will be clear even without the roentgen diagnosis. But even so it seems to me that the method has its value, as a means of throwing light upon the extent and topography of the process. We all know how difficult it often can be to locate a cavity in bone that is as hard as ivory. Besides, there are cases in which the clinical symptoms fail and the roentgen diagnosis serves to clear up the diagnosis. Furthermore, the method gives an exact picture of the extent of the pneumatisation, and of the location of the sinus.

## XVIII. P. Flemming Møller, Copenhagen: Early Diagnosis of Tuberculous Enterocolitis [1]

The author speaks of the earlier investigations into the problem of the roentgen diagnosis of tuberculous and ulcerative colitis. He dwells on the work that has in recent years been done in that direction, in the United States, and particularly on that of Brown and Sampson, of the Saranac Lake Sanatorium, near New York, whose method he describes. He then presents the result of his own investigation of 52 cases from the Tuberculosis Ward of the Frederiksberg Hospital, 41 of which were authentic cases of pulmonary tuberculosis. The investigation and the changes in the intestine are illustrated by means of numerous roentgenograms showing the development of the affection in its different stages. Of the 41 positive cases of pulmonary tuberculosis, 21 — or more than half — had tuberculous enterocolitis. Of those, only 5 had presented such clinical symptoms

[1] Published *in extenso* in the *Acta Tuberculosa Scandinavica*, vol. IV, fasc. 4.

that a diagnosis of: »probably tuberculous enteritis» might have been made. Four had presented vague dyspeptic symptoms, on which no certain diagnosis could be built; while 12 — more than half, consequently — had not had even the slightest symptoms of any kind that might in some way or other suggest a tuberculous enteritis. These figures show how important it is that the intestine should be roentgen-examined in cases of pulmonary tuberculosis. They also clearly show how ineffectual the ordinary clinical examination is, when it is a question of an early diagnosis of tuberculous enterocolitis.

The author discusses the treatment of the tuberculous affection of the intestine by means of carbon-arc light. At the time of which he is speaking, that therapy had been employed in 16 cases. Of those, 8 were after-examined, and in 5 of these the roentgen picture showed that there was improvement; one of the five was even completely cured.

With a little experience the examination is not a difficult one to make. Its value as a guide for the conduct of the treatment, and for judgment with regard to the prognosis of a given case, is sure to be very great.

### Discussion:

I. Gösta Forssell: Dr. Flemming Møller's investigation confirms what is already a well-known experience; namely, that those symptoms which we notice in the roentgenograms, from the small intestine and the colon, are determined partly by established anatomical changes, infiltrations and ulcerations; partly by pathologic phenomena of movement — which he still, to-day, calls: »spasms» — in the wall of the intestine. Those so-called spasms produce defectuosities in the lumen, which he believes to be characteristic for tuberculosis.

To those observations of Dr. Flemming Møller's I beg leave to make a few remarks. What he describes as »spasms» of the intestine are typical functional variations of its lumen determined by the plastic moulding of the mucous membrane. In several of his pictures, the »defectuosities» which he describes in the lumen vary in a manner typical for the plastic variations of the mucosa. The plastic movements of the mucous membrane can cause the form of the lumen to change from that of an even tube to the most varied formations. The mucosa may fill it en tirely, and in such a manner that the roentgen picture shows a complete »defectuosity»; or in such a manner that the lumen becomes of varying width and shape. Those variations of the mucous membrane can be combined with the most varied contractions of the muscular coat of the intestine itself. It is not at all a question of »spasms», in the sense of any convulsive contraction of the muscles. It is the manifestation of an immensely complex and for the digestive tube characteristic mechanism of movement, which I should think has been well known for several years. To speak of the movements of that mechanism as »spasms» is just as misleading as if one were to say that a person mentally afflicted is suffering from »spasms of the brain».

All the types of movement and variations of form described by the speaker can occur in a normal intestine; only their combination and their permanence are pathologic, and are probably the result partly of changes in the wall of the intestine itself, partly of reflex action. It is quite possible that in the cases described by the speaker those movements are due to a tuberculous process in the intestine; but plastic movements of the intestine precisely similar can be caused both by inflammatory processes and by tumors — for instance by an ileocecal cancer. Before this audience simply to diagnosticate these phenomena as »spasms» is to relegate intestinal diagnosis ten years back, and to evade what is actually the

problem; namely, what changes does tuberculosis of the intestine cause in the autoplastic mechanism of that organ?

II. P. FLEMMING MØLLER quite agrees with Prof. FORSSELL that the changes observed in the intestine in cases of tuberculous colitis are due to a pathological projection of the mucous membrane, and are the indications of an increased activity of the latter, due to the ulcerous condition.

## XIX. P. Flemming Møller: Contribution to the Roentgen Diagnosis of Ulcerative Processes in the ventricular Canal, Especially as Regards Pyloric Gastritis and Duodenitis [1]

The author compares the changes that one finds at the ileocecal junction in cases of tuberculous enterocolitis with the conditions in the antrum and the bulbus duodeni when, clinically, there exists a so-called pyloric gastritis. He takes his starting point from the reflexion that a superficial ulcerative process in the intestinal canal — as, for instance, the tuberculous enterocolitis — excites the mucous membrane of that organ into hyperactivity, and that, consequently, the changes found in the roentgen picture in cases of that disorder must be regarded as a pathologic projection of the mucosa into the intestinal space. His study is based on the investigations of FORSSELL concerning the movements of the mucous membrane of the digestive tract.

The author thinks that in his examination of cases that clinically could be diagnosed as pyloric gastritis he has found changes in the roentgen picture which may be characterised as typical. These, he enumerates briefly as follows:

1) late filling of the bulbus duodeni; flossy, indented outline of the isolated stomach shadow toward the pyloric portion;

2) defective filling at points of the prepyloric portion, showing in the roentgenogram as a fading of the normal outline and an irregular, penniform and ragged outline of the mucous membrane, where constantly recurring shapes of the defectuosities can, however, be recognised in the very much varying filling;

3) occasional niche formations.

4) Sometimes the filling defects are not markedly ragged and penniform, but show rather as a granular, pellucid defective filling, in which also the defective outlining and changing aspect of the picture is less pronounced.

5) The changes are entirely similar to the ones found in cases of ulcerative colitis, especially in the tuberculous ones. They must be regarded as indications of a superficial affection of the mucous membrane. In appearance they are different from the classical pictures of ulcus duodeni and pyloric ulcers.

### Discussion:

I. — GÖSTA FORSSELL: In his description of the roentgen picture seen in ulcerative processes in the ventricle, Dr. FLEMMING MØLLER makes exactly the same mistake as in his description of the roentgen findings in tuberculous enterocolitis; that, namely, of neglecting to take into account the phenomena of a normal moulding of the mucous membrane, and of once more falling back on the old idea

[1] A preliminary communication. The paper *in extenso* will appear later.

of »spasms» — though, to be sure, he now transfers those »spasms» to the mucosa. Normally, a complete closing of the canalis ventriculi may occur as the result of a plastic moulding of the mucous membrane such as I have described in detail as long ago as in 1913.

The movements of the mucosa, which he describes, can occur in cases of ulcus in the stomach or duodenum. They can also occur in all sorts of conditions where there is irritation of the stomach. The phenomena differ from the manifestations of the normal mucosal mechanism chiefly by the greater permanency of the resulting formations.

To define and explain the typical picture of the mucosa in cases of ulcus it is necessary to go deeper into the problems than done by the author, And, at least, one must take into account the mechanism which moulds the mucous membrane and determines the roentgen picture of the stomach — namely, the autoplastic mechanism of the stomach.

## XX. P. Amundsen, Oslo: A Case of Disseminated Condensing Osteitis

In an unmarried female, 30 years old, who had hitherto always been in good health, and whose only complaint was about a feeling of soreness in the right side of the abdomen, extending down along the right leg, roentgen examination of the bony structure showed some peculiar spotty consolidations in the epiphyses and metaphyses, and, in a few places, in the diaphyses as well. Only the skull, ribs, collar-bones and vertebral column were free from such. The patches were of different sizes and shapes, up to 3 cm. long and 0.5 cm. broad; most of them smaller. They were sharply outlined, and for the most part localised to the spongiosa. In a few places, however, they appeared to be situated in the corticalis, without extending beyond the surface of the bone. The longitudinal axis of these oblong, oval patches invariably lay in the longitudinal axis of the bone. They were most numerous in the head and neck of the femur, all the way down to the trochanter, and in the hip-sockets.

The literature contains 9 earlier descriptions of this anomaly, variously labelled as: Osteopathia (ostitis). condensans disseminata, Ostéite condensante généralisée sans symptômes cliniques, Multiple Kompaktherde in der Knochenspongiosa, and Ostéopoécilie.

N. Voorhoeve believes this anomaly to be hereditary, and thinks it should be classed under the group of the dyschondroplasias.

## XXI. T. Dale, Oslo: Roentgen Examination of the Symphysis in Pregnancy

The author has made a roentgen examination of the symphysis in:

a) 10 women who had never been pregnant;

b) 15 not pregnant, who had born several years ago;

c) 35 pregnant ones in whom there were no indications of softening of the symphysis resulting from their condition;

d) 19 pregnant ones who had pains resulting from softening of the symphysis owing to their pregnancy.

He used a new technic; namely, of passing a 1 mm. aluminum tube up into the vagina, just back of the symphysis, with the film placed on a holder inside the tube. The roentgenograms give a sharp picture of the bone, and a correct measurement of the width of the separation between the two parts of the symphysis.

In groups *a* and *b*, the width of the separation was, on the average, 4 mm., and the design of the bone normal.

In group *c*, average width of separation, 6 mm.; bone design on the whole normal.

In group *d*, average width of separation, 7 to 8 mm. In nearly half of these cases, the picture showed calcareous atrophy of the bones close to the separation, together with a flossiness of the periosteum. Nearly all showed a fissure medially in the cartilage.

## XXII. M. Paus, Oslo: A Case of Fibrous Osteitis.

## XXIII. » » : A Case of Tuberculosis of the Sacroiliac Articulation.

## XXIV. Sven Junghagen, Umeå: Monomeric Eburnous Osteosis

Since 1922, when LERI and JOANNI published a case of this »disease», 5 other cases have been described in the literature. A case of the same kind I have myself had occasion to study roentgenologically, follow throughout clinically, and even examine pathoanatomically by osteotomy.

As the name indicates, the process consists in a sclerotic or eburnating degeneration of the bone, and is monomeric — that is, localised to one extremity alone. The osseous change seems to begin in an early age. In MUZII's case, the patient was 11 months old. Clinically, it results in an increase of the volume of the limb; secondarily in deforming arthritic changes in the articulations of the latter, owing partly to hyperostotic developments along their cortical envelope, partly to displacements from that cause.

The genesis of the disorder has been the subject of much discussion. Organic diseases, with secondary osteosclerosis as accessory affection, such as lues, Sternberg's disease, leucemia, and others, have been suggested, but any such idea is entirely disproved by the clinical picture. Against osteous changes of the nature described by ALBERS SCHOENBERG speaks the localisation to a single extremity; Paget's disease, with its characteristic roentgen picture, can also easily be set aside.

PUTTI, on the basis of pathoanatomical examination, feels justified in asserting the eburnation to be the result of a vasomotoric neurosis; and for this he would find support in the investigations made by the two Danish authors, BENZEN and JANSEN, concerning Ollier's disease. Inasmuch, however, as the eburnation — as already shown by LEWIN and MCLEOD — cannot be considered to correspond to any definite vascular distribution; and as, furthermore, I myself have not been able to verify PUTTI's pathoanatomical observations, that explanation can hardly be considered as fully substantiated, as yet.

In 1926, in discussing this case with my chief at the time, Dr. EDLING, who had kindly placed it at my disposal, I ventured the suggestion — thinking of the

embryology of the extremities — that the change might be determined by congenital conditions, and thus in the nature of an anomaly. That is also the conclusion come to by ZIMMER.

## XXV. Paul Jacoby: Myelomatosis of the Spinal Colon in a Child of 8 Years.[1]

JACOBY demonstrated radiograms of myelomatosis in the spinal colon of a child, 8 years old. All the vertebræ were considerably flattened, hour-glass shaped, deficient in calcium, and the intervertebral spaces enlarged.

## At the joint Meeting with the Members of the Northern Surgical Association[2]

## Gösta Forssell, Stockholm: On the Permanency of Radiological Healing in Malignant Tumors[3]

Owing to the different character of the healing process in radiotherapy and after radical operation it is necessary to closely study the permanency of the radiological healing as compared with the healing after a radical surgical intervention. The author has examined the question of the permanency of the radiological healing of tumors by studying, in the first place the results of treatment after at least five years observation, on the Radiumhemmet's material of skin-, lip-, oral and uterus cancer and sarcoma; in the second place, the frequency of recurrence, and the period of latency for such recurrences.

The result of the investigation shows the frequency of permanent healing after radiotherapy, for the above-named groups, to be quite as great, if not greater than after radical operation in cases of the same kind. The frequency of recurrence after obtained primary healing by radiotherapy is generally less, and, at least, for none of the groups higher, than after radical operation. Somewhat over half of the recurrences occurred within the first year after primary healing, and most of the others during the second and third years. After five years, recurrences after radiological healing are rare.

The author has investigated what factors have a bearing on the permanency of the radiological healing. He finds them to be, in the very first place, the degree of development and the biological character of the tumor. For the primary healing, its radiosensibility is of great moment; but for the final result no prognosis can be made on that basis; in fact, that is often better with tumors less radiosensitive. It is of the greatest importance that cancer cases should come under radiological treatment at an early stage, and that the whole treatment should be firmly organised in the form of radiotherapeutic clinics under thoroughly expert management and direction.

[1] Published in the next no. of the Acta Radiologica.

[2] For the full report of this Meeting see the *Proceedings of the Northern Surgical Association*.

[3] Published *in extenso* (in English) in the *Acta Radiologica*, Supplementum II; and (in German) in LAZARUS: Handbuch der gesamten Strahlenheilkunde, II. Band, 3. Lief.

# List of Members Attending the Congress

### From Denmark

Dr. Baastrup, Chr. I., Copenhagen
» Collin, Edv., »
» Jacoby, Paul, Odense
» Juul, Jens, Copenhagen
» Jørgensen, V., Vejle
» Lomholt, Svend, Copenhagen
» Møller, P. Flem., »
» Nielsen, J., »
Ing. Palle, J., »
» Thorsen, V., »

### From Norway

Dr. Amundsen, Per, Oslo
» Baastad, V. Friis, »
» Bakke, Sigv., Bergen
» Berle, E., Oslo
» Bohne, F., Trondhjem
» Dale, T., Oslo
Ing. Furuheim, V., Oslo
Dr. Gundersen, E., Kristianssand
» Hald, Drammen
» Heyerdahl, Oslo
» Johansen Tideman, Oslo
» Nitter, H., Skien
» Nordrum, Fin, Sandefjord
» Norland, Stavanger
Dr. Paus, M.,Oslo
» Schiander, A. W., Oslo
» Sverre, I., »
» Thue, H., »
Prof. Vegard, Lars »
Dr. Wennevold, Hans Chr., Lillehammer
» Werenskiold, B., Oslo

### From Sweden

Dr. Andrén, Gunnar, Stockholm
» Berven, E., »
» Carlsten, Dag, Malmö
» Edling, Lars, Lund
Prof. Forssell, G., Stockholm
Dr. Fürst, C., Målilla
» Hellmer, Hans, Stockholm
» Heyman, J., »
» Junghagen, Lund
Ing. Järnh, Br., Stockholm
Dr. Larsén, T., Örebro
» Lundgren, G., Stockholm
» Odquist, H., Göteborg
» Runström, G., Umeå
» Scholander, Ax., Hälsingborg
» Simon, M., Stockholm
» Westermark, N., »
» Åkerlund, Å., »

# Contents of the Proceedings of the Sixth Meeting of the Northern Association of Medical Radiology


Minutes of the Ordinary Meeting . . . . . 91

Scientific Transactions . . . . . 92

The Organisation of the Jubilee Foundation's Cancer Campaign in Sweden . . . . . *G. Forssell* . . . . . 92

Discussion: *Panner, Collin, Forssell, Heyerdahl, Forssell* . . . . . 92

The Norwegian Radium Hospital . . . . . *S. A. Heyerdahl* . . . 93

Discussion: *Forssell, Heyerdahl, Edling* . . . . . 94

The Treatment of Lip Cancer, Especially as Regards the Metastases . . . . . *Edv. Collin* . . . . . 95

Discussion: *Heyerdahl, Edling, Collin* . . . . . 95

Observations on the Radiotherapy of Carcinoma recti . . *Jens Nielsen* . . . . 97

Discussion: *Heyerdahl, Forssell, Flemming Møller, Collin, Nielsen* . . . . . 97

The Result of the Combined Treatment of Cancer mammae at Radiumhemmet 1921—23 . . . . . *Nils Westermark* . . . 99

Discussion: *Forssell* . . . . . 100

On Cumulation of Irradiation in Malignant Tumors, and the Therapeutic Effect of Irradiation with Massive and Divided Doses, and by the Saturation Method, Respectively; as Studied on Cancer Mice . . . . . *Jens Juul* . . . . . 102

The lethal Dose for Mice as biological Unit of Measurement . . . . . *Paul Jacoby* . . . . 103

Results of Radiation Treatment of Myoma of the Uterus and Menorrhagia . . . . . *S. A. Heyerdahl* . . 104

Roentgen Treatment of Leucemia . . . . . *T. Dale* . . . . . 105

Discussion: *Flemming Møller, Heyerdahl* . . . . . 105

A new, practical Method for the Use of Radium in the Treatment of Skin Diseases . . . . . *Sv. Lomholt* . . . . 108

Four hundred Cases of Angioma treated with Radium . . *Jens Nielsen* . . . . 108

Discussion: *Collin, Lomholt* . . . . . 109

Two Years' Experience with Bucky's »Soft Ray« Treatment. *M. Norland* . . . . . 109

Discussion: *Lomholt, Forssell* . . . . . 111

On Roentgen Examination of the Lung, compared with the clinical Diagnosis and Post-Mortem Findings . . *T. Dale* . . . . . 112

Discussion: *Forssell* . . . . . 113

Studies on Acute, Massive Collapse of the Lung . . . . *Nils Westermark* . . 113
The Biological Basis for the Use of Light as a Therapeutic Agent . . . . . *Sv. Lomholt* . . . . 114
On the Distribution of Energy in the Ultra-violet Portion of the Spectra of different Carbon-Arcs (with a special view to the measuring of doses) . . . . . *V. Thorsen* . . . . . 115
A Contribution to the Roentgen Technic for Examination of the Temporal Bone, in Cases of Chronic Changes Originating from the Ear . . . . . *G. Runström* . . . . 116
Early Diagnosis of Tuberculous Enterocolitis . . . . . *P. Flemming Møller* . 117
Discussion: *Forssell, Flemming Møller* . . . . . 118
Contribution to the Roentgen Diagnosis of Ulcerative Processes in the ventricular Canal, Especially as Regards Pyloric Gastritis and Duodenitis . . . . . *P. Flemming Møller* . 119
Discussion: *Forssell* . . . . . 119
A Case of Disseminated Condensing Osteitis . . . . . *P. Amundsen* . . . . 120
Roentgen Examination of the Symphysis in Pregnancy . *T. Dale* . . . . . 120
A Case of Fibrous Osteitis . . . . . *M. Paus* . . . . . 121
A Case of Tuberculosis of the Sacroiliac Articulation . . *M. Paus* . . . . . 121
Monomeric Eburnous Osteosis . . . . . *Sven Junghagen* . . . 121
Myelomatosis of the Spinal Colon in a Child of 8 Years. *Paul Jacoby* . . . . 122

## At the joint Meeting with the Members of the Northern Surgical Association

On the Permanency of Radiological Healing in Malignant Tumors . . . . . *Gösta Forssell* . . . . 122
List of Members Attending the Congress . . . . . 123

## Council of the Northern Society for Medical Radiology 1927—1929

*Norway:*

S. A. Heyerdahl, M. D., Oslo. *President.*
E. Berle, M. D., Oslo
H. Thue, M. D., Oslo
A. W. Schiander, M. D., Oslo

*Denmark:*

A. Reyn, M. D., Copenhagen
Chr. I. Baastrup, M. D., Oslo. *Secretary General.*
P. Flem. Møller, M. D., Copenhagen
H. J. Panner, M. D., Copenhagen.

*Finland:*

G. A. Wetterstrand, M. D., Helsingfors
G. Jansson, M. D., Helsingfors
A. Hornborg, M. D., Helsingfors

*Sweden:*

G. Forssell, Prof., Stockholm
Å. Åkerlund, M. D., Stockholm
L. Edling, M. D., Lund

## Honorary Members of the Northern Association of Medical Radiology

A. Béclère, M. D. Paris.
John Berg, Professor. Stockholm.
J. Bergonié, Professor †. Bordeaux.
R. D. Carman, M. D.†. Rochester, Minn., U. S. A.
James T. Case, M. D. Battle Creek, Mich., U. S. A.
William David Coolidge, Ph. D. Schenectady N. Y. U. S. A.
Marie Curie, Professor. Paris.
J. F. Fischer, Professor †. Copenhagen.
Rudolph Grashey, Professor. München.
Guido Holzknecht, Professor. Wien.
Robert Kienböck, Professor. Wien.
Robert Knox, M. D. †. London.
Joseph Nachmanson, Esq. †. Stockholm.
E. G. Pfahler, Professor. Philadelphia, Penn., U. S. A.
Herman Rieder, Professor. München.
W. C. von Roentgen, Professor †. München.
Sidney Russ, D. Sc., Professor. London.
Ernest Rutherford, D. Sc., F. R. S., Professor. Cambridge.
Tage Sjögren, M. D. Stockholm.
Albert Soiland, M. D. Los Angeles, California, U. S. A.
Lars Vegard, Ph. D., Professor. Oslo.

## Members of the Danish Association of Medical Radiology 1929

### — Dansk Förening för Medicinsk Radiologi —

*Honorary Member*

Prof. Gösta Forssell. Stockholm.

*Ordinary Members*

Ing. Andersen. Schlegelsalle 9. København.
Dr. Leif Arntzen. Jagtvej 207. København.
Dr. Chr. I. Baastrup. St. Kongensgade 68. København.
Dr. P. G. K. Bentzon. Stadens Vænge 1. København.
Dr. G. Biering. Ny Vestergade 18. København.
Ing. M. Caroc. Vodroffsvej 26. København.
Dr. Ole Chievitz. Finsens med. Lysinstitut. København.
Dr. E. Collin. Vestre Boulevard 45. København.
Ing. Drenck. Nørre Alle 3. København.
Dr. V. Finsen. *Secretary.* Kildegaardsvej 44. Hellerup.

Dr. A. Hansen. Kolding.
Prof. H. M. Hansen. Juliane Mariesvej 30. København.
Dr. H. Haxthausen. Hammerensgade 3. København.
Dr. Agnete Heise. Pilestræde 52. København.
Dr. L. Henriksen. Værnedamsvej 11. København.
Dr. P. F. Honoré. Rosengaarden 12. København.
Dr. Poul Jacoby. Odense.
Dr. Anton Jensen. Valbirkevej 3. Hellerup.
Dr. Jens Juul, Landskronagade 63. København.
Dr. Victor Jørgensen. Vejle.
Dr. C. Krebs. Aarhus.
Ing. Johan Kühl. Ingemannsvej 8. Aarhus.
Ing. Holger Larsen. Jernbanegade 6. København.
Dr. S. B. Larsen. Herløv.
Dr. Lau. Faxe.
Dr. E. de Fine Licht. Aarhus.
Dr. Sv. Lomholt. Vodroffsvej 50. København.
Ing. Lundbeck. N. Frihavnsgade 84. København
Dr. Lundstein. Vordingborg.
Dr. P. Flemming Møller. *President.* Vesterbrogade 140. København.
Dr. Jacob Nordentoft. Nykøbing Mors.
Ing. Palle. Nicolaj Plads 34. København.
Dr. H. J. Panner. H. C. Ørstedsvej 70. København.
Dr. Carl Permin. Bøgevej. Hellerup.
Dr. Axel Reyn. St. Kongensgade 130. København.
Dr. Riis. Aarhus.
Dr. E. Samuelsen. Bülowsvej 48 A. København.
Dr. Scheuermann. Amaliegade 43. København.
Dr. K. Wegge. Hunderupvej 61. Odense.
Ing. Wilkens. Jernbanealle 67. Valby. København.
Dr. O. Wissing. Bredgade 43. København.
Dr. O. Wolff. Classensgade 27. København.

*Foreign Members:*

Dr. D. B. Carlsten. Malmö. Sweden.
Dr. L. Edling. Lund. Sweden.
Dr. A. Scholander. Hälsingborg. Sweden.

## Members of the Dutch Association of Electrology and Roentgenology

### — Nederlandsche Vereeniging voor Electrologie en Röntgenologie —

*Honorary Members*

Prof. Dr. H. Haga. Zeist.
Dr. Hoorweg. †.
Prof. Dr. K. F. Wenkebach. Boltzmannsgasse 12. IX Weenen.
Prof. Dr. J. K. A. Wertheim Salomonson. †.
Prof. Dr. P. Zeeman. Stadhouderskade 158. Amsterdam.
Prof. Gösta Forssell. Stockholm.
Prof. Cl. Regaud. Paris.

*Council*

Dr. H. A. M. N. Lammers. *President.*
Dr. J. W. F. Heukensfeldt Jansen. Breitnerstraat 3. Amsterdam. *Secretary.*
Arts Mej. M. J. Dentz. Ramstraat 1.3 Utrecht *Treasurer.*
Dr. L. Arisz.
Arts F. G. de Wilde.

*Librarian*

Arts L. G. Heilbron. van Breestraat 51. Amsterdam.

*Ordinary Members*

Arts J. J. A. Aghina. Utrechtschestraat 23. Amersfoort.
Arts J. A. Arendsen Hein. Laan v. Meerdervoort 46 a. den Haag.
Dr. L. Arisz. Schenkkade 222. den Haag.
Dr. J. van Assen. Westersingel 103. Rotterdam.
Arts J. Ph. Backer. Keizersgracht 550. Amsterdam.
Arts D. L. Bartelink. Mooksche Baan. Nymegen.
Arts S. G. F. Bendien. Slotlaan 14. Zeist.
Arts P. Bisschop. Oranjelaan 36. Dordrecht.
Arts Ph. van Blankenstein. 's Gravendykwal 68. Rotterdam.
Arts J. Boosman. Ministerie v. Oorlog. Bandoeng. (N. I.)
Arts C. W. Bottema. Helder.
Dr. J. G. ter Braak. Tiel.
Arts J. F. L. van Breemen. Keizersgracht 489. Amsterdam.
Arts W. K. Brevet. Velperweg. Arnhem.
Dr. W. Bronkhorst. San. Berg en Bosch. Apeldoorn.
Arts W. P. Byvoet. N. Hilversumscheweg 128. Bussum.
Arts P. C. Cleyndert. N. Plantage 121 b. Delft.
Arts O. Daan. Philipsfabrieken. Eindhoven.

Dr. K. A. F. Deelen. Stationsstraat. Tilburg.
Arts B. van Delden. Hengeloschestraat 42. Enschede.
Arts Mej. M. J. Dentz. Ramstraat 13. Utrecht.
Arts S. Diamant. Orthenstraat 53. 's Hertogenbosch.
Arts P. J. Ph. Dietz. Duinweg 37. Den Haag.
Arts D. Doyer. Bothalaan 12. Baarn.
Dr. L. F. Driessen. van Miereveldtstraat 3. Amsterdam.
Prof. Dr. J. van Ebbenhorst Tengbergen. Koninginneweg 144. Amsterdam.
Arts H. E. A. Fermin. Ministerie v. Oorlog. Bandoeng. (N. I.)
Arts H. J. Ph. Fesevur. Ceintuurbaan. Deventer.
Arts L. Fick. Hoogstraat. Bergen op Zoom.
Arts J. Frank. Enschedestraat 82. Hengelo.
Arts G. F. Gaarenstroom. Keizersgracht 669. Amsterdam.
Arts L. J. J. van Ginneken. Burgstraat 5. 's Hertogenbosch.
Dr. D. H. van der Goot. Sweelinckstraat 4. Den Haag.
Arts J. J. Halbertsma Jr. Jan Luykenstraat 28. Amsterdam.
Dr. R. J. Harrenstein. Weteringschans 141. Amsterdam.
Arts L. G. Heilbron. van Breestraat 51. Amsterdam.
Arts K. M. C. Herzberg. Weenen.
Dr. L. Hertzberger. Joh. Vermeerstraat 37. Amsterdam.
Dr. W. van Heyningen. Hollanderstraat 85. Den Haag.
Dr. M. R. Heynsius van den Berg. P. de Hoochstraat 8. Amsterdam.
Arts Mej. A. Hissink. Jan Luykenstraat 96. Amsterdam.
Arts D. den Hoed. Sarphatistraat 106. Amsterdam.
Dr. J. Houtman. Lomanstraat 15. Amsterdam.
Dr. J. W. F. Heukensfeldt Jansen. Breitnerstraat 3. Amsterdam.
Arts K. de Jong. Frederik Hendrikplein 33. Den Haag.
Arts J. Ph. Joosten Hattink. Wageweg 44. Haarlem.
Arts S. Keyser. Goeman Borgesiuslaan 15. Groningen.
Dr. M. Koch. Soerabaja.
Arts E. C. Th. de Kock van Leeuwen. Marisplein 8. Den Haag.
Dr. C. H. Kok. Julianalaan 17. Utrecht.
Arts A. Kropveld. Oosterpark 27. Amsterdam.
Arts W. H. Kuipers. Noordersingel 98. Leeuwarden.
Arts J. H. Kuyer. Koninginnegracht 8. Den Haag.
Arts P. H. Lamberts. Catharynesingel 36. Utrecht.
Dr. H. A. M. M. Lammers. Bergweg 323. Rotterdam.
Dr. A. A. G. Land. Wageweg 40. Haarlem.
Dr. H. C. van der Lee. Enkhuizen.
Arts D. M. Levie. Ziekenhuis Calvariënberg. Maastricht.
Arts W. Chr. van der Linden. Noordsingel 11. Rotterdam.
Arts H. Litwer. Nassaukade 20. Amsterdam.
Dr. A. H. M. E. Lommen. Bergstraat 18. Arnhem.
Dr. H. F. Lumentut. Weltevreden.
Dr. M. W. Marsman. Sarphatikade 20. Amsterdam.
Arts W. F. J. Milatz. Mauritsweg 44. Rotterdam.
Dr. A. Montagne. Jz. Crabethstraat 9. Gouda.
Dr. M. Mortier Hymans. de Ruyterstraat 74. Den Haag.
Arts H. C. Nauta. Riouwstraat 3. Bandoeng. (N. I.)
Prof. Dr. W. Noordenbos. Emmaplein 10. Amsterdam.
Dr. J. Oomen. Biltstraat 101 c. Utrecht.
Dr. C. Orbaan. Dam G 39. Middelburg.
Arts J. L. C. Overbosch. Arnhem.
Arts E. Penso. Weteringschans 20. Amsterdam.
Prof. Dr. B. J. van der Plaats. Batavia.
Mevrouw A. van der Plaatz Keyzer. Batavia.
Arts G. J. van der Plaats. Geertekerkhof 14. Utrecht.
Dr. J. B. Polak. P. C. Hooftstraat 163. Amsterdam.
Arts P. B. V. Quartero. Stationsweg 4. Rotterdam.
Arts M. Radjiman. Solo. (N. I.)
Arts J. J. A. Rodbard. Deventerstraat 36. Apeldoorn.
Dr. P. H. van Roojen. Westzyde 91. Zaandam.
Dr. D. J. Steenhuis. Rynsburgerweg 17. Leiden.
Arts L. van den Steen van Ommeren. Minervalaan 39. Amsterdam.
Dr. M. L. van der Stempel. Nic. Maesstraat 82. Amsterdam.
Dr. H. W. Stenvers. Maliebaan 43. Utrecht.
Arts H. Timmer. Sarphatistraat 56. Amsterdam.
Dr. K. C. A. Valken. Zonnekade. Heemstede.
Arts H. A. Veltman. Stationsweg. Heerenveen.
Arts A. Verhegen. Padang. (N. I.)
Dr. C. G. Vervloet. Stationsweg 19 b. Rotterdam.
Arts F. M. J. de Wever. Wilhelminaplein 13. Heerlen.
Arts E. Wiener. Keizersgracht 394. Amsterdam.
Arts F. G. de Wilde. Wilhelminalaan 6. Alkmaar.
Dr. M. M. Wolff. van Speykstraat 3. Den Haag.
Arts H. E. van Ysendyk. Spoorsingel 45. Delft.

*Extraordinary Members*

Dr. A. Bouwers. Emmasingel 16. Eindhoven.
Ir. J. Cohen Stuart. Eusebius Buitensingel 58. Arnhem.
Ir. K. Cohen Stuart. Eusebius Buitensingel 58. Arnhem.
Ir. H. de Fouw. 204/6 Great Portlandstreet, London W. 1.
Ir. W. Hondius Boldingh. Koekoeklaan 14. Eindhoven.
L. J. Koopman. van Breestraat 167. Amsterdam.

Ir. I. I. C. van der Linden. Rokin 86. Amsterdam.
Ir. J. R. de Man. Langegang 26. Antwerpen.
Ir. J. E. Schröder. Julianalaan 6. Ryswyk.
Ir. Jhr. N. S. C. Stoop. Zeestraat 69. Den Haag.
T. Westerdyk. Paradysweg 20. Zandvoort.
Ir. Witholt. Leeuwendallaan 37. Ryswyk.
Ir. G. M. Utermark. Garenkokerskade 67. Haarlem.

## Members of the Finnish Association of Medical Radiology

### — Finska Föreningen för Medicinsk Radiologi —

Dr. N. Berner. Kuusankoski.
Prof. O. A. Boije. Helsingfors.
Dr. A. Elfving. Viborg.
Dr. N. Emeleus. Tammerfors.
Dr. H. Fogelberg. Helsingfors.
Dr. H. G. Haahti, Helsingfors.
Dr. K. Holmberg. Helsingfors.
Dr. V. Horelli. Harjavalta sanatorium.
Dr. A. F. Hornborg. Helsingfors.
Dr. C. G. Jansson. Helsingfors. *Secretary.*
Dr. L. Lindström. Wasa.
Dr. E. E. Niemi. Lahti.
Dr. G. Nyström. Borgå.
Dr. B. Nyström, Helsingfors.
Dr. L. Ollonqvist. Helsingfors.
Dr. Hj. Peder. Gamlakarleby.
Ing. A. Pehrsson. Helsingfors.
Dr. O. Pikkarainen, Helsingfors.
Dr. E. Ruin. Helsingfors.
Dr. I. Sallinen. Helsingfors. *Treasurer.*
Dr. Y. Seuderling. Helsingfors.
Dr. E. Sillman. Helsingfors.
Dr. L. Taipale, Helsingfors.
Dr. A. Tefke. Norrmark.
Dr. G. A. Wetterstrand. Helsingfors. *President.*
Dr. M. Zall, Helsingfors.
Dr. R. Öhman. Jakobstad.

## Members of the Norwegian Association of Medical Radiology

### — Norsk Forening for Medicinsk Radiologi —

*Honorary Member*

Prof. L. Vegard, Oslo.

*Ordinary Members*

Dr. Amundsen, P. Chr. Augustsgt. 23. Oslo.
Dr. Baastad, W. Friis. Daae'sgt. 18. Oslo.
Overlæge Bakke, S. N. Bergen. *Vice president.*
Dr. Bentzen, T. E. Ullevålsvn. 90. Oslo.
Dr. Berle, E. F. Holbergsgt. 25. Oslo.
Dr. Bohne, F. Trondhjem.
Dr. Dale, T. Rikshospitalet. Oslo. *Secretary.*
Ing. Furuheim, V. Rosenkrantzgt. 11. Oslo.
Prof. Gleditsch, E. Universitetet. Oslo.
Dr. Gundersen, E. Kristianssand.
Dr. Hald, J. K. Drammen.
Overlæge Heyerdahl, S. A. Chr. Augustsgt. 23. Oslo.
Dr. Johansen, Tideman. Halvd. Svartesgt. 40 b. Oslo.
Ing. Markert, K. Rosenkrantzgt. 11. Oslo.
Overlæge Nitter, H. Skien.
Dr. Nordrum, F. Sandefjord.
Dr. Norland. Stavanger.
Dr. Paus, M. Josefinegt. 30. Oslo.
Dr. Schiander, A. W. Chr. Augustsgt. 14. Oslo.
Dr. Sverre, I. Grönland 10. Oslo.
Dr. Thue, H. Incognitogt. Oslo. *President.*
Prof. Vegard, L. Universitetet. Oslo.
Dr. Wennevold, H. Chr. Lillehammer.
Dr. Werenskiold, B. Vår Frueshospital. Oslo.

# Members of the Swedish Association of Medical Radiology

## — Svenska Föreningen för Medicinsk Radiologi —

### *Honorary Members*

Prof. Manne Siegbahn. Uppsala.
Prof. John Berg. Stockholm.
Dr. Tage Sjögren. Stockholm.

### *Ordinary Members*

Dr. Hugo Ahlbom. Serafimerlasarettet. Stockholm.
Dr. J. A. Almblad. Mönsterås.
Dr. Gunnar Andrén. Lasarettet. Karlstad.
Dr. Sigfrid Arnell. Lasarettet. Gävle.
Dr. Gustaf Asplund. Brahegatan 27. Stockholm.
Dr. Fredrik von Bergen. Sahlgrenska sjuk. Göteborg.
Dr. Elis Berven. Radiumhemmet. Stockholm.
Dr. Olof Björlin. Sturegatan 16. Stockholm.
Dr. Verner Bohm. Lasarettet. Hudiksvall.
Dr. Gösta Bohmansson. Lasarettet. Örebro.
Dr. Birgit Broomé. Hantverkaregatan 10. Stockholm.
Dr. Dag B. Carlsten. Allm. sjukh. Malmö.
Dr. Herbert Carlsund. Sabbatsbergs sj. Stockholm.
Dr. Claes Carlström. Viktoriagatan 11. Göteborg.
Dr. Einar Edberg. Barnsjukhuset. Göteborg.
Dr. Lars Edling. Lasarettet. Lund.
Prof. Gösta Forssell. Sophiahemmet. Stockholm. *President.*
Dr. Carl Fürst. Målilla Sanat. Målilla.
Dr. Wenzel Gejrot. Bergsgatan 43. Stockholm.
Dr. Gösta Gråberger. Akad. Sj. röntgenavd. Uppsala.
Dr. Erik Hagberg. Polhemsgatan 31. Stockholm.
Prof. Patrik Haglund. Sturegatan 62. Stockholm.
Dr. Nils Hansson. Sveavägen 76. Stockholm.
Dr. Mauritz Hedenberg. Eksjö.
Dr. Hans Hellmer. Sophiahemmet. Stockholm.
Dr. James Heyman. Östermalmsgatan 43. Stockholm. *Treasurer.*
Dr. Richard Hjelm. Akad. sjukh. Uppsala.
Dr. Olof Hultén. Akad. sjukh. Uppsala.
Prof. H. C. Jacobæus. Engelbrektsplan 2. Stockholm.
Dr. Sven Johansson. Sahlgrenska sjukh. Göteborg.
Dr. Sven Junghagen. Lasarettet. Umeå.
Ing. Bror Edv. Järnh. Malmtorgsgatan 8. Stockholm.
Dr. August Karsten. Odengatan 40. Stockholm.
Prof. Einar Key. Stadsgården 22. Stockholm.
Dr. Torben Klason. Lasarettet. Linköping.
Dr. Folke Knutson. Heleneborgsgatan 10. Stockholm.
Dr. Teodor Larsén. Lasarettet. Örebro.
Dr. Hugo Laurell. Akad. sjukh. Uppsala.
Dr. Bengt Lilja. Radiumhemmet. Stockholm.
Dr. Asta Lindahl. Lasarettet. Lund.
Dr. Ad. Lindblom. Lasarettet. Karlskrona.
Dr. Silas Lindqvist. Centrallasarettet. Stocksund.
Dr. Gunnar Lundgren. Birger Jarlsgatan 27. Stockholm.
Dr. Arvid Lundqvist. Lasarettet. Sundsvall.
Dr. Erik Lysholm. Serafimerlasarettet. Stockholm.
Dr. Wolfgang Magnusson. Radiumhemmet. Stockholm.
Dr. Ludvig Moberg. Humlegårdsgatan 13. Stockholm.
Dr. Axel Odelberg. Garnisonssjukhuset. Boden.
Dr. G. Odelberg-Johnsson. Apelvikens Kustsanat. Varberg.
Dr. Arvid Odencrants. Floragatan 13. Stockholm.
Dr. Henning Odqvist. Carlanderska Sjukhemmet. Göteborg.
Dr. Yngve Olsson. Lasarettet. Kristianstad.
Dr. Lennart Norrlin. Lasarettet. Västerås.
Dr. Einar Perman. Sveavägen 52. Stockholm.
Dr. Axel Renander. Sahlgrenska sjukh. Göteborg.
Dr. Gösta Renck. Lasarettet. Norrköping.
Dr. Olle Reuterwall. Kungsgatan 79. Stockholm.
Dr. Gösta Runström. Lasarettet. Västerås.
Dr. Carl Sandström. Birkagatan 1. Stockholm.
Dr. Olof Sandström. Kaplansbacken 3. Stockholm.
Dr. Eugen Saul. Lasarettet. Falun.
Dr. Jörgen Schaumann. Kungsgatan 19. Stockholm.
Dr. Åke Schéle. Norra Strandgatan 12. Jönköping.
Dr. Axel Scholander. Lasarettet. Hälsingborg.
Ing. Georg Schönander. Birger Jarlsgatan 16. Stockholm.
Dr. Rolf Sievert. Radiumhemmet. Stockholm.
Dr. Nils Silfverskiöld. Runebergsgatan 6. Stockholm.
Dr. Moritz Simon. Drottninggatan 71. Stockholm.
Dr. Anders Sonesson. Rörstrandsgatan 20. Stockholm.
Dr. Vilhelm Stenström. Univers. Hospital. Minneapolis. U. S. A.
Dr. C. G. Sundberg. Fysiol. inst. Uppsala.
Prof. Gustaf Söderlund. Östermalmsgatan 84. Stockholm.
Dr. Sven Thunström. Lasarettet. Lund.
Dr. Åke Törnblom. Sanatoriet. Sandträsk.
Dr. Sven Wahlgren. Lasarettet. Hälsingborg.
Dr. Henning Waldenström. S:t Görans sjukh. Stockholm.
Dr. Arvid Wallgren. Föreningsgatan 2. Göteborg.
Dr. Nils Westermark. S:t Görans sjukh. Stockholm. *Secretary.*
Dr. Axel Westman. Allm. B. B. Stockholm.
Dr. Einar Winther. Lasarettet. Halmstad.
Ing. Robert Thoræus. Radiumhemmet. Stockholm.
Dr. Ernst Åkerblom. Bjästa.
Dr. Åke Åkerlund. Norr Mälarstrand 22. Stockholm.
Dr. Birger Östman. Smålandsgatan 4. Stockholm.

# Membres de la Société Suisse de Radiologie

## — Mitglieder der Schweizerischen Roentgen-Gesellschaft —

(Janvier 1930)

### *Membres d'Honneur*

Antoine Béclère. Rue La Boëtie. Paris.
Peter Debye. Zurich. (Actuell:t München.)
Gösta Forssell. Bergsgatan 2. Stockholm.
Hermann Hopf. Laupenstr. 53. Berne.
W.-Conrad von Röntgen. †. München.

### *Comité*

Dr. René Gilbert, P.-D. *Président.* 3, Place Claparède. Genève.
Dr. Gustave Clément. *Vice-Président.* Fribourg.
Dr. André Grosjean. *Secrétaire français.* Les Arbres. La Chaux-de-Fonds.
Dr. Paul Scheurer. *Deutscher Sekretär.* Molzgasse 8. Biel.
Dr. R. Feissly. *Trésorier.* Lausanne.
Dr. Fr. Zollinger, P.-D. *Anc. président.* Zürich.
Dr. L. Exchaquet. *Anc. président.* Lausanne.

### *Bibliothécaire.*

Mme Dr. Max Steiger, Thunstr. 36, Bern.

### *Membres.*

Dr. Rob. Amman. Sonnenquai 30. Aarau.
Dr. Ch. Attenhofer. Boul. de Grancy. Lausanne.
Dr. Frl. A. Baltischwyler. Samariterstr. 16. Zurich 7.
Dr. Edoardo Barchi. Bellinzona.
Dr. Ernst Baumann. Langenthal.
Dr. M. Baumann. Schönenwerd.
Dr. Jean Baumgartner. Place Neuve 2. Genève.
Dr. J. Berger. Liestal.
Dr. Franc. Bernasconi. Chiasso.
Dr. F. Berthoud, Rue de l'Athénée 4. Genève.
Dr. P.-M. Besse. Rue de Candolle 20. Genève.
Dr. Emilio Bianchi. Lugano.
Dr. Eug. Bircher. Spitalarzt. Aarau.
Dr. P. Böhi. Privatklinik. Frauenfeld.
Dr. W. Böhni. Stein a/Rhein.
Dr. Erich Bosch. Dufourstrasse 30. Zürich.
Dr. Alfr. Brettauer. Bahnhofstr. 55. Zürich.
Dr. Hans Brun, P.-D. Privatklinik z. Bergli. Luzern.
Dr. Max Brunner. Pfäffikon (Zürich).
Dr. P. Buess. Sissach.
Dr. Fr. Büeler. Greifengasse 7. Basel.
Dr. Julius Bürli. Oberentfelden. (Aargau.)
Dr. Rob. Chable, Prof. Rue de l'Hôpital. Neuchâtel.
Dr. D. Chessex. Territet-Montreux.
Dr. G. Clément. 8 rue Vogt, Fribourg.
Dr. S. Cuendet. Hôtel des Postes. Yverdon.
Dr. Henri Curchod. La Sarraz.
Dr. Jules Curchod. Boul. Georges Favon 19. Genève.
Dr. J. Custer. Berneck (Rheintal).
Dr. Pierre Decker. Chemin des Magnolias. Lausanne.
Dr. Ernest Démiéville. Chésières s/Ollon.
Dr. Franç. Descoeudres. Montbrillant. La Chaux-de-Fonds.
Dr. K. Dössekker. Rämistrasse 5. Zürich 1.
Dr. W. Dössekker. Bubenbergstr. 9. Bern.
Dr. E. Ducrey. Montana.
Dr. M. Düring. Zürichstr. 14. Luzern.
Dr. Iak. Eberhard. Theaterstr. 18. Luzern.
Dr. Eggenberger. Bezirksspital. Herisau.
Dr. W. Eggerling. Rotachstr. 35. Zürich.
Dr. L. Exchaquet Av. du Théâtre 3, Lausanne.
Dr. R. Favre. Logengasse 17. Biel.
Dr. Franz Felder. Wolhusen.
Dr. R. Feissly. Av. d'Ouchy 47. Lausanne.
Dr. Arn. Ferri. Via P.-Lucchini. Lugano.
Dr. Flach. St. Moritz.
Dr. A. Fonio. Langnau i/E.
Dr. Ernst Forster. Klinik Obach. Solothurn.
Dr. Paul Forster. Bielstr. 138. Solothurn.
Dr. A. Franzoni. Locarno.
Dr. G. Franck. Parc 13. La Chaux-de-Fonds.
Dr. Frank. Baden.
Dr. Franz Galli. Notkerstrasse 10. St. Gallen.
Dr. M. Gähwyler. Arosa.
Dr. Gamrat. Theaterstr. 8. Zürich.
Dr. I. Geiser. Oberwil (Baselland).
Dr. Maurice Gilbert. Leysin.
Dr. René Gilbert. 3, Place Claparède. Genève.
Dr. Curt v. Graffenried. Amthausgasse 24. Bern.
Dr. Ed. Gressot. Porrentruy.
Dr. A Grosjean. Les Arbres. La Chaux-de-Fonds.
Dr. I. Gsell. Fraumünsterstr. Zürich.
Prof. Dr. H. Guggisberg. Kanonenweg. Bern.
Dr. Arthur Guth. Bahnhofstrasse 39. Zürich.
Dr. Gottfr. Häemig. Tödistrasse 36. Zürich.
Dr. O. Häuptli. Rheinfelden.
Dr. Max Hausmann. Marktgasse 11. St. Gallen.
Dr. Heinrich Häusser, P.-D. Bürgerspital. Basel.
Dr. Leon Helg. Montreux.
Prof. Dr. Karl Henschen. Chirurg. Klinik. Bürgerspital. Basel.
Dr. Frl. Martha Hofstetter. Optingenstr. 10. Bern.
Dr. W. Howald. Burgdorf.

Dr. Rud. Hugentobler. Asylstrasse 10. Zürich.
Dr. Rob. Isenschmid, P.-D. Hirschengraben 6. Bern.
Dr. Marc Jaquerod. Grand Hôtel. Leysin.
Dr. André Jeanneret. La Chaux-de-Fonds.
Dr. Alb. Jentzer, P.-D. Rue de l'Université 8. Genève.
Dr. W. Jordi. Centralplatz 47. Biel.
Prof. Dr. Ch. Juillard. Rue du Rhône 2. Genève.
Dr. Ed. Juillard. Porrentruy.
Dr. P. Jung. Spitalarzt. St. Gallen.
Dr. A. Käppeli. Sursee.
Dr. W. Kottmann. Spitalarzt. Solothurn.
Dr. H. C. Krafft jun. Av. de la Gare. Lausanne.
Prof. Dr. E. Kummer. Av. Champel 15. Genève.
Dr. Aug. Lassueur. Av. de la Gare 1. Lausanne.
Dr. H. Largiader. Chefarzt d. Krankenhauses. Flawil.
Dr. Fr. Lichtenhahn. Arosa.
Dr. Ad. Liechti, P.-D. Hallwylstr. 32. Bern.
Prof. Dr. Max Lüdin. Leimenstr. 28. Basel.
Dr. E. Lüscher, P.-D. Schanzerstr. 6. Bern.
Dr. Alb. Lüthi. Spitalarzt. Bälliz. Thun.
Dr. Julius Mack. Av. de la Gare 1. Lausanne.
Dr. Ch. Martin-Du-Pan. P.-D. Hôpital des Enfants mal. Genève.
Dr. Louis Merian. Bahnhofstr. 69. Zürich.
Dr. Emil Mettler. Industriestr. 14. Rorschach.
Dr. Georges Meyer. Neuchâtel.
Dr. Gust. Moppert, P.-D. Rue de Candolle 16. Genève.
Dr. Muff. Affoltern a/A.
Dr. Bernhard Müller. Route des Alpes. Fribourg.
Dr. Hermann Müller. Mühlebachstr. 17. Zürich.
Prof. Dr. Otto Naegeli. Schmelzbergstr. 40. Zürich 7.
Prof. Dr. Oskar Naegeli. Monbijoustrasse. Bern.
Dr. D. v. Niederhäusern. Heiligenschwendi.
Dr. Eugen Nienhaus. Villa Fortuna. Davos-Platz.
Dr. Ch. Niquille. Av. de la Gare 36. Fribourg.
Dr. Gaston Perlet. Bubenbergplatz. Bern.
Dr. Ch. Perret. Pré Boisé. Clarens.
Dr. Henri Perrier. Rue St. Léger 6. Genève.
Dr. Jules Perrier. Vevey.
Dr. C. Pettavel, P.-D. Neuchâtel.
Dr. Paul Pfähler. Olten.
Dr. Angelo Pometta. Kantonsspital. Aarau.
Prof. Dr. Fr. de Quervain. Kirchenfeldstr. 60. Bern.
Dr. W. Raaflaub. Gurtengasse 6. Bern.
Dr. R. Ramser. Niederbipp.
Dr. Ernst Reinert. Solothurn.
Dr. Hans Reinhart. Stalden 77. Solothurn.
Dr. L. Rengger. Bahnhofstr. 31. Zürich.
Dr. Rhonheimer. Gartenstr. 10. Zürich 2.
Dr. Max Richard. Bürgerspital. Basel.
Dr. Ernst Rieben. Spitalarzt. Interlaken.
Dr. Fritz Ris. Engestrasse 23. Bern.
Prof. Dr. A. Rosselet. Av. du Léman 51. Lausanne.
Prof. Dr. C. Roux. Place Montbenon. Lausanne.
Dr. E. Ruppanner. Spitalarzt. Samaden.
Dr. Fancino Rusca. P.-D. Locarno.
Dr. Ernst Rychner. Finkenhubelweg. Bern.
Dr. Ch. Saloz, P.-D. Rue Marc Monnier 1. Genève.
Dr. H. Schaad. Herzogenbuchsee.
Dr. Schäppi. Brugg.
Dr. H. Schenk. Luisenstr. 41. Bern.
D. Paul Scheurer. Molzgasse 8, Biel.
Prof. Dr. H. R. Schinz. Krautgartenstr. 2. Zürich.
Dr. A. Schirmer. Waisenhausstr. 16. St. Gallen.
Dr. Jakob Schmid. Leysin.
Dr. W. U. Schnyder. Balstahl.
Dr. H. Schoch-Kraut. Wülflingen (Aargau).
Dr. Rob. Schweizer. Stadelhoferstr. 15. Zürich.
Dr. Siegrist-Staehli, jun. Spitalarzt. Brugg.
Dr. Frl. Anny Spinner. Pflegerinnenschule. Zürich.
Prof. Dr. Rud. Staehelin. Bernoullistr. 26. Basel.
Dr. H. Stauffer. Hintere Bahnhofstr. 102. Aarau.
Dr. Steinegger. Lachen (Schwyz).
Dr. E. Stettler. Nydecklaube 8. Bern.
Dr. F. Stupnicki. Pestalozzistr. 4. Burgdorf.
Dr. Ad. Suter. Bahnhofstr. 14. Zürich.
Dr. Herm. Suter. Bahnhofstr. 22. Zürich.
Dr. Gustave Turini. Sierre.
Dr. S. Ulrich. Freie Strasse 190. Zürich.
Prof. Dr. Henri Vuillet. Av. de la Gare. Lausanne.
Dr. A. Voegeli. Bahnhofstr. 61. Zürich.
Dr. Albert Vogel. Reuss-Steg 3. Luzern.
Dr. H. v. Waldkirch. Wytikonerstr. 31. Zürich.
Dr. H. Walther. Schwesternhaus v. Roten Kreuz. Zürich.
Dr. Em. Wehrle. Wettsteinplatz 6. Basel.
Dr. R. Weibel. Unter-Hallau (Schaffhausen).
Dr. R. Welti. Yverdon.
Dr. Max Winkler. Alpenstr. 7. Luzern.
Dr. Wuhrmann. Kilchberg (Zürich).
Dr. Ed. Wyss. Wallgasse 6. Bern.
Dr. Armin Ziegler. Bankgasse 20. Winterthur.
Dr. R. Zollikofer. St. Gallen.
Dr. Fr. Zollinger. Unionstr. 5. Zürich 7.